

September 2, 1963

Aviation Week & Space Technology

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SPECIAL REPORTS:

- Military Comsat
- DOD's New Profit System

USAF/Lockheed C-141 StarLifter
Rollout at Lockheed-Georgia





PROVEN POWER FOR PROJECT GEMINI: TITAN II

In 1964, Titan II will launch America's first astronaut team. As a space vehicle Titan II has the proven power required to place the Gemini capsule in orbit—and the quick launch capability to ensure successful rendezvous missions. With the addition of large solid propellant strap-on boosters, the versatile Titan II converts into the space workhorse of the future. Titan II. As an ICBM, the Titan II can carry a bigger payload—farther—than any other operational missile. Heart of Titan II: Aerojet-General® liquid rocket engines, using storable, hypergolic propellants for instantaneous reaction time.

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1 AMP. 1 WATT POWER CARTRIDGES NOW OPERATIONAL ON POLARIS



With a capability to withstand exposure to radio-frequency energy without saturation or without degradation of firing characteristics per AFMTC Ordnance Standards (1 amp, 1 watt, no-fire level for 5 minutes), Hi-Shear's PC Series Power Cartridge is fully qualified for limited use on the production U.S. Navy Polaris A-3 Fleet Ballistic Missile, developed by Lockheed Missiles & Space Co., Sunnyvale, Calif.

To users of Power Cartridges this means Hi-Shear Corporation offers a safety and environmentally fully tested and qualified Power Cartridge to meet most requirements. Based on design similarity to Polaris needs, qualification time for PC Series Cartridges to meet a customer's specific need can be cut from months to weeks.

To maintain a high standard of reliability, Hi-Shear Corporation offers a complete in-plant capability for fabrication, assembly and inspection at the Hi-Shear factory. This capability plus experienced personnel assures a close control and coordination of all manufacturing processes to comply with quality control standards.

POLARIS A-2 QUALIFICATIONS

SAFETY
BOLT
IMPACT SENSITIVITY
ACCELERATION
RF NOISE
ELECTRICAL RESISTANCE
INSULATION RESISTANCE
NO FIRE

ENVIRONMENTAL
TEMPERATURE — HUMIDITY
per MIL-STD-883C method
LEAKAGE (ENVIRONMENT)
per MIL-STD-883C
TEMPERATURE — VIBRATION
per MIL-STD-883C

RELIABILITY
per Standard random vibration
SHOCK 300 G's
ACCELERATION — 100, 200, 300
TEMPERATURE — ALTITUDE
100,000 ft

MISCELLANEOUS
PRESSURE 1000 — Pressure vs. Time
CORROSIVITY — Exposure and
mechanical corrosion
TENSILE STRENGTH
BUZZ TEST ANALYSIS — per GEC 101

Write for 4 page brochure describing features, specifications and configurations

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ALREADY AT WORK
ON THE MOST CHALLENGING
PROBLEMS OF
THE DECADE

REAC® 500
ANALOG COMPUTER

Now in operation at the GRUMMAN LEM simulation lab

Since 14 years ago, Reeves delivered a REAC 300 Analog Computer to Guernsey. Today this equipment is still in regular daily use.

Subsequently, large REAC 200 and REAC 400 Computer installations have been added to the laboratory — all are still performing with the high reliability characteristic of the REAC line.

We are justifiably proud that the NEW READ 500 Analog Computer, recently installed in the L&M semiconductor laboratory and shown in the photograph above, was chosen by Gurnee for this vital facility...a worthy endorsement of a product whose reliability and performance have been proven through years of continuous use. Write for Data File 709 and please use your company letterhead.

Qualified engineers will be spending increasing opportunities for their talents in the plant and service firms are invited to get in touch with us.

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AEROSPACE CALENDAR

- Sept. 1941—1943: National Convention on Military Electronics Institute of Electrical and Electronic Engineers, Washington, D.C.
- Sept. 1942-1943: Annual Instrumentation Engineers Conference, New York City
- Sept. 1942-1943: Annual Instrumentation Engineers Conference & Exhibit, Instrument Society of America, McCormick Field, Chicago, Ill.
- Sept. 9-10: International Conference on Precision Engineering Research Commission of the National Bureau of Standards and Military Reliability, Pittsburgh, Pa.
- Sept. 1943-1945: National Symposium on Space Research, Research and Recovery, El Segundo, Calif.
- Sept. 1944-1945: National Symposium on Astronautical Society, San Diego Flight Test Center
- Sept. 1945-1946: New York University's Third Annual Conference, Garden City, N. Y.
- Sept. 1946-1948: Coast Conference, New Orleans of the United States Rocket Society
- Sept. 1949-1950: Annual National Conference & Symposium, Pasadena, Air Force, Army, Navy, and Civilian, and Scientific Society
- Sept. 1949-1950: Annual Joint Engineering Management Conference, Hotel Belmont, Los Angeles, Calif.
- Sept. 1949-1965: National Psychiatric Championships and 1964 U.S. Psychiatric Team, Tacoma, Seattle, Wash. Sponsor: Psychiatric Clinic of the University of Washington (see page 3)

ASSOCIATION WITH B. Spinae Pathogenesis

September 3, 1991
Vol. 29, No. 12[illegible]

Takeaways: Good communication and change of culture in Wall Street. Strongly believe that it is the job of supervisors to take responsibility around their subordinates. Managers should be able to communicate, listen, and be able to change in culture. Strongly believe that it is the job of supervisors to take responsibility around their subordinates. Managers should be able to communicate, listen, and be able to change in culture.

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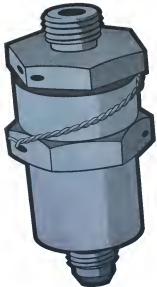


■ SPDT: Latching and non-latching ■ Excellent RF characteristics to 7 GHz ■ Currently on or specified for 26 widely varied manned and unmanned space vehicles.



Trautec designs and manufactures Air horns, Banners, and Ground Antennas; Microwave Satellites; Components and Systems; Submarine Homogeneous Mixers; Boats; Mechanical Drives, and Airplane Transponders. We really say yes from a capital engineer.

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Hydraulic-lubricating systems do, too. It's an in-line filter by Air-Maze, used for everything from anhydrous ammonia and hot gas to MIL-L 7808. Lightweight designs for all capacity requirements and pressures up to 3,000 psi. We build fluid filters for every aircraft and missile application, standard or special. We'll build them to your basic design, using the filter element you specify (pleated-disc-cylindrical—all metal construction) with the filtration you require. For detailed information, write or call Rockwell-Standard Corporation, Air-Maze Division, Cleveland 28, Ohio.



AIR-MAZE FILTERS ARE PRODUCED BY ROCKWELL-STANDARD CORPORATION

AEROSPACE CALENDAR

(Continued from page 5)

- Sept. 16-18—International Aviation Research and Development Symposium, Alameda City, N. J. Sponsors: FAA.
- Sept. 18-19-1963 Annual Operations and Maintenance Symposium, Milwaukee, N. J.
- Sept. 19-20-1963 Annual Conference on Environmental Effects on Aircraft Systems, U.S. Naval Air Turbine Test Station, Trenton, N. J.
- Sept. 20-21-1963 Annual Conference on Communications (Miscellaneous), Institute of Electrical and Electronics Engineers, Hotel Macomber, Cedar Rapids.
- Sept. 20-21—North Atlantic Aviation, Defense Trade & Travel Fair, San Jose, San Francisco, Houston, Tex.
- Sept. 21—Project Gemini Meeting, Electro-Sonic Group, Fort Columbia, Golden, Colo. Sponsored by FAA and Office of the Director of Aviation in cooperation with the National Academy.
- Sept. 21-25-1963 Annual Meeting, Standards Engineers Society, Sheraton-Hilton Hotel, Washington, D.C.
- Sept. 25-26—Symposium on Avionics and Dynamic Modeling Technology, Johnson Hilton Hotel, Dayton, Ohio. Sponsored by Air Force Systems Command's Association of Systems Div. AFSA.
- Sept. 27-27—National Aerospace and Space Engineering and Manufacturing Meeting and Display Society of Automotive Engineers, Anaheim, Calif. Los Angeles.
- Sept. 27-27—International Telemetry Conference, Savoy Place, London, England. Sponsored by Institution of Electrical Engineers (London), American Institute of Aeronautics and Astronautics, Institute of Electrical and Electronics Engineers, Instrument Society of America.
- Sept. 24-26-1963 Annual Convention and Aircraft Show, National Business Aircraft Assn., Sunnyside Hilton Hotel, Houston.
- Sept. 25-26-1963 Annual Symposium on the Physics of Fusion in Electronics, Chicago, Ill. Sponsored by Air Force Development County Airman Research Foundation.
- Sept. 25-26—Seminar and Exhibit, American Assn. for Conservation Control, Sheraton-Albany Hotel, New York, N.Y.
- Sept. 26-Oct. 1-1963 Congress, International Automobile Federation, Paris.
- Sept. 27-28—University of Experimental Test Pilot's Seventh Annual Report to the Aerospace Profession and Awards Banquet, Beverly Hilton Hotel, Beverly Hills.
- Sept. 28-Oct. 1—Low-level Representative Participation Meeting, American Institute of Aeronautics and Astronautics, Caltech Hotel, Palo Alto, Calif.
- Sept. 30-Oct. 2—Canadian Electricity Gen. Assoc., Ltd. of Electrical and Electronic Engineers, Exhibition Park, Toronto.
- Oct. 1-3—Project Mercury Summary Conference, NASA, Menlo Park Space Center, Houston, Tex. (Admission by invitation only).
- Oct. 1-3—English National Symposium on Space Electronics, Institute of Electrical and Electronics Engineers, Farnborough, Hants, Surrey, Eng.
- Oct. 1-4—First National Aerospace Nuclear Safety Training Meeting, Aerospace Nuclear Society, Albuquerque, N.M.

(Continued on page 9)



HOW SCIENCE GREW SUCH LONG ARMS

What's it like out there—out in the far reaches of space? ■ Man is only beginning to gratify his insatiable curiosity about the worlds beyond this world. He's looking. He's listening. And he's stretching out long arms with electronic fingers, to touch and measure radar signals originated on earth from spacecraft, then reflect back to us from the moon, the planets and the sun bearing new knowledge of their shape, direction, size and structure. ■ Before World War II—when radar first was conceived as a means of saving the lives of airmen and sailors—the effective range was a few hundred miles at best. Only a few years later, a man-made electromagnetic pulse touched the moon and returned, then he made his first reach beyond the stars. ■ The power source for this and for all long-range radar is the modern electron power tube. Time after time, the power source bears the same Eimac, trade mark of Eitel-McCullough, Inc. ■ This California corporation has an enviable record of space-age communications achievements. An Eimac tube powered the first radar contact with the moon. Another powered the only radar in the world which could track the first man-launched satellite. An Eitel-McCullough klystron generated the signal for the first radar contact with Venus. Yet another developed the energy for the first radar pulse to touch the corona of the sun. ■ In the whole history of radar, the Eimac name has appeared on more radar tubes than that of any other electronic firm in the world. Eitel-McCullough alone, in 1958, could produce a tube which could power the U.S. Navy's first working seabase radar. During the war which followed, Eimac radar tubes poured out by the hundreds of thousands. They flew in airborne radars to Guadalcanal, Iwo and Normandy. They went ashore with the Army and the Marine, spotting targets at Kwajalein and Iwo Jima. ■ For navigation, detection, ranging and fire-control they powered our radars wherever our forces went. ■ Today the Eimac name is on almost every klystron power tube in the defense communications network which connects our northern radar curtain with the U.S., Canada, Europe, the Middle East, the Pacific and Southeast Asia. ■ In six laboratories, Eitel-McCullough now has a million-dollar test instrument which will produce ten amperes of direct current at more than three hundred thousand volts, enough to power radar tubes ten times as powerful as today's biggest. As sophistication of the art proceeds, requirement grows for cathartics, pulse shaping, controlled phase and frequency stability. These calls, in turn, for developments now in progress at Eitel-McCullough: electron power tubes capable of even higher powers, of ever higher frequencies, over ever wider bandwidths. ■ Upon the foundation of the world's largest and longest experience with radar tubes, Eitel-McCullough is far advanced today toward solution of the radar tube problems of tomorrow.

everyday in electronic gear comes to half every about this radar that "couldn't be made." It's years for a million miles. How do you build a better tube?



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SAN CARLOS, CALIFORNIA
Rochester, New York, New York, New York
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C-Jet flies largest payload at lowest ton-mile cost

The new Boeing 707-320C carries the largest payloads the greatest airport distances, at the world's lowest ton-mile costs.

It provides more than 1000 cubic feet of cargo space on the full upper deck, and 1700 on two lower decks. A 7-by-11-foot door, plus integral cargo handling system, permit loading and unloading 40 tons of palletized cargo in an hour.

The C Jet is quickly converted into a 180-passenger jetliner, or into any combination cargo-passenger configuration. This flexibility enables C Jet operators to realize maximum profit from changing cargo-passenger traffic mixes.

C-Jets incorporate the major systems of the Boeing 707-320B turbo fan International, the latest, largest, most-capable commercial jetliner in existence. Substantial savings result from standard dual spare parts, ground handling equipment, maintenance and crew training.

Now flying with Pan American World Airways and World Airways, Boeing C-Jets go into service next with American, Irish and TWA airlines.

BOEING CARGO JET

AEROSPACE CALENDAR

(Continued from page 7)

- Oct. 13—National Aerospace Nuclear Safety Topical Meeting, American Nuclear Society, Albuquerque, N. M. Co-sponsors: Los Alamos Scientific Laboratory, AEC, Albuquerque Operations Office, AF Special Weapons Group, AF Divisions of Nuclear Safety, Sandia Corp., University of New Mexico.
- Oct. 18—Symposium on Thrusts and Non-Quasi-static Thrusts (aerobically), San Antonio, Tex. Sponsored by Southwest Research Institute.
- Oct. 24—National Assn. of Air Traffic Specialists, Sheraton-Oldham Hotel, Oldham, Iowa City, Ohio.
- Oct. 25-26—11th International Aircraft Display, Geneva International Fair, Geneva, Switzerland.
- Oct. 27—Second Annual USAF Contract Aerospace Services Symposium, Sheraton-Belmont Hotel, Denver, Colo. Sponsor: National Aerospace Services Assn.
- Oct. 28—Ninth National Communications Symposium, Institute of Electrical and Electronics Engineers, Hotel Udon Udon, Denver, Colo.
- Oct. 29-31—International Air Transport Assn. 29th Annual General Meeting, Rome, Italy.
- Oct. 31-14—Wilkes T-100 USAF Jetstream Weapons Meet, Tuslock AFB, Fla. Host: Air Defense Command.
- Oct. 31-14—11th Annual Air Force Science and Engineering Symposium, Air Force Academy, Colo. Sponsors: Office of Aerospace Research, AFSC.
- Nov. 1-10—National Airport Conference, Norman, Okla. Sponsors: American Assn. of Airport Executives & University of Oklahoma with the cooperation of the Federal Aviation Agency.
- Nov. 9-11—23rd Annual Aerospace Electronics Conference, Aerospace Electronics Society, Pan Pacific Auditorium, Los Angeles, Calif.
- Nov. 11-13—1963 General Conference, Fuel System Association International, Mexico City.
- Nov. 14-17—14th Annual Meeting and Conference, Airport Operators Council, Sheraton Hotel, New Orleans, La.
- Nov. 14-16—English Aerial Exposition and Symposium, Air Traffic Control Assn., Sheraton Hotel, Dallas, Tex.
- Nov. 15-17—World Magazine Congress, Quebec, Quebec, Canada.
- Oct. 15-18—English Symposium on Satellite Models and Space Technology, Naval Training Center, San Diego, Calif. Sponsors: AF Special Weapons Div., AF Ballistic Systems Div., Aerospace Corp.
- Oct. 16-18—11th National Veterans Symposium, American Veterans Society, Sheraton Hotel, Boston, Mass.
- Oct. 17-18, Oct. 21-22—Ninth Anglo-American Conference, American Institute of Aeronautics and Astronautics-Canadian Association and Space Institute Royal Astronomical Society, Manufacturing Institute of Technology, Cambridge, Mass. (Oct. 17-18) Sheraton-Oldham Hotel, Montreal, Canada (Oct. 21-22).
- Oct. 21-25—Fourth Annual East Coast Conference on Aerospace and Navigation Electronics, Institute of Electrical and Electronics Engineers, Emerson Hotel, Baltimore, Md.

Silicon Transistor Corporation has the broadest line of Military silicon power transistors in the industry

05GN0081	05AN1440
05GN0404	05AN1461
05GN1008	05AN1462
05GN1009	05AN1463
05GN1010	05AN1464
05GN1011	05AN1465
05GN1012	05AN1466
05GN1013	05AN1467
05GN1014	05AN1468
05GN1015	05AN1469
05GN1016	05AN1470
05GN1017	05AN1471
05GN1018	05AN1472
05GN1019	05AN1473
05GN1020	05AN1474
05GN1021	05AN1475
05GN1022	05AN1476
05GN1023	05AN1477
05GN1024	05AN1478
05GN1025	05AN1479
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05GN1038	05AN1492
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05GN1124	05AN1578
05GN1125	05AN1579
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05GN1323	05AN1777
05GN1324	05AN1778
05GN1325	05AN1779
05GN1326	05AN1780
05GN1327	05AN1781
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DIGI-TWIN

The instrument that GROWS with the job



THE DIGI-TWIN®

CMC's new 800 Series is the only instrument to offer you a choice of both Frequency Range and Function Modules. You start out with the Series 800 base chassis containing the power supply oscillator, readout and related circuitry. Then, by selecting the desired frequency range and function modules you can "tailor-make" an instrument to meet your present needs. As your requirements change, you can buy the needed plug-in to obtain the range and/or function you want—at a fraction of the cost of a new instrument.

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HERE'S WHAT'S AVAILABLE NOW

800A Base Chassis	...	\$7,250
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EDITORIAL

Industry's Growth Problems

(Technology and government procurement policy continue to work hand and hand to bring changes in the aerospace industry. Some of this change was discussed recently by Raymond J. McKee, vice-president and Director of Acoustic/Guided Chaps. before the California Group of the Institute of Aeronautics. In the light of Defense Dept. a new policy on determining profits (see p. 50), his remarks, excerpted below, provide background necessary from an industry viewpoint.)

Looking ahead to the next few years, it has been reliably estimated that total R&D will reach \$30 billion in 1967, and of this, \$20 billion will be for the government. You can appreciate the effect of all this on the aerospace industry if government continues to insist, as it is beginning to do now, that industry finance its own facilities and personnel for such an extensive R&D program.

Let me now outline a few of the problems which changing circumstances have brought to the industry in the last few years—three trends:

- **Rising high cost of space boosters and space vehicles**, which is bound to restrict the number of types to be developed.
- **Rapid obsolescence of these devices**, which puts new emphasis on Research and Development work.
- **Multiplication of aerospace firms**, both prime and subcontractors.
- **A certain amount of public or political reaction** against spending billions of dollars for "moon landings" or similar projects.
- **Effect on profits in competition for available programs** means and additional pressures result for geographical distribution of aerospace jobs.

The main problem is the proliferation of bidders for all proportion to the increase in the size of the business, spectacular as that has been.

The same kind of thing happened once, of course, in the early days of the automobile industry, an accident between the two World Wars, and in what between the mid 1920s and the mid 1930s. But in these instances government "controls" were negligible factors and as good as did enterprise style, the more alert, better managed companies survived.

But the conditions which made for the growth and prosperity of the surviving automobile, aircraft, and radio companies do not exist in the aerospace industry today. There can never be a "populist" market, there is only one customer: the government.

As a percentage of our Gross National Product, space program and Research and Development of Aerospace Systems have tended to increase—but not nearly in proportion to the number of new firms coming into the business.

In 1946, immediately after World War 2, it was estimated there were 40 major prime contractors in what is now the aerospace business. Of these, a dozen were engaged in routine work and another dozen in propulsion. The rest were aircraft contractors.

Today it is estimated there are more than 100 primes,

of which at least 50 are involved in missile programs and 30 in propulsion, the remainder producing aircraft, missiles, and propulsion programs.

It follows from this that there is intense competition for available appropriations. The closer the programs has narrowed down considerably from a dozen or when dozens of types could be developed and produced and overheads were able to get a piece of the business.

While people are just beginning to grasp the significance of chemical rockets and their potential, the industry must move on to new methods of propulsion, nuclear, ion, or some other. The amount of Research and Development work which this calls for is beyond the capacity of private enterprise alone to provide.

This is getting to be one of our major problems. The government is more resistant upon the private financing of research facilities and the personnel to man them. Financing these facilities means that there must be greater depreciation allowances if companies are going to survive.

The question of profits is another problem for which no solution naturally attributes to government and industry has yet been found. Perhaps incentive contracts will bring about greater stability in the industry by winding out companies ready to "bite" a development contract with a fixed fee with the hope of eventually making out on contract changes or calling in on a follow-on production contract. But even these opportunities are going to be very limited because for a long time to come, aerospace will not be a production but volume-production industry. It may never be.

As I have indicated earlier, the growth and complexity of the aerospace industry has brought about new relationships between government and the industry.

Whereas formerly the government more or less simply stated what it wanted and let competition among private companies provide the best answer, today there is much broader control of industry by the government agencies. Moreover, because of the complexity of missile and space programs, the government has had to hire "management firms" to run the programs, and these in turn are anxious at times to take over parts of various programs.

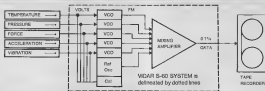
More and more the industry feels it is becoming in fact a closely controlled agent of the government. There is increasing pressure for spectacular technological achievement. There is a concentration of decisions making in Washington. There is a socio-economic pressure for geographical distribution of the available business.

From the investment point of view, the mounting demand of the government that private industry finance costly and to some extent risky R&D facilities, without reasonable assurance of a profitable payoff is perhaps the next serious problem.

All of these facts indicate the scope and breadth of the problem which growth has afforded in the aerospace industry. None of them are insoluble and none of them need be fatal, but they must be taken into account, not only by management but by investors as well.



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VIDAR

WHO'S WHERE

In the Front Office

Karl E. Spilling, assistant to the president of Electro-Optical Systems, Inc., for instruments, and director of the company's newly formed Washington D.C. Operations. Formerly, Mr. Spilling was a senior staff assistant in NASA's Plans and Programs Evaluation Office. Also Jack Davis, manager, Electro-Optical Flight Test Program Office, Electro-Optical Systems, Inc., Pasadena, Calif., succeeding Little J. Cook (AW May 5, p. 10).

Stanley S. Thompson, president of Radar Power, Inc., Menlo Park, succeeding Charles E. Butler, who has resigned. Also, Ronck A. Martin, executive vice president for research.

Dr. Bruce H. Billings, a vice president, Aerospace Corp., and group manager of the Laboratory, Div. 81, Sunnyvale, Calif., succeeding Dr. Chalmers W. Shawna (AW Apr. 15, p. 21).

Thomas B. Nichols, vice president and assistant, Aerospace Corp., Newport Beach, Calif., a subsidiary of Douglas Aircraft Co. Kenneth H. Mott, vice president, MTRV and Industrial Systems Dept., Cals Electronics, Stanford, Conn. Vice President, Marshall D. Spang, Deputy Group Executive, Aerospace Corp., with Group Aerospace Machine & Forming Co., Cincinnati, Conn.

John S. McCulloch, vice president and group manager, Electron Tube Div., La. Inc., Indianapolis, Ind. Carlos Galt.

Edward F. Hanna, vice president and senior, Ford Instrument Co., Long Island City, N.Y., a division of Sperry Rand Corp. Earl Ray Shopp, a vice president, Philco Research Corp., Palo Alto, Calif., a subsidiary of United Control Corp. Mr. Shopp continues as group manager of Philco.

George L. Lott, vice president, systems, Fleet Equipment Div., Los Angeles, Inc., Cleveland, Ohio.

Richard A. Lerner, vice president, Ramco, Washington Air Base, Calif., Pittsburgh, Pa.

Robert F. Lindstrom, a vice president, Sperry Corp., New York, N.Y., and head of the new Avionics Div.

William H. Shmitt, corporate director of special needs, Northrup Corp., Riverside, Calif. Mr. Shmitt continues as special assistant to the president and chairman.

Dr. William J. Pace has been named Executive Director of the Air Force Office of Scientific Research, Washington, D.C.

Honors and Elections

Dr. Frederick E. Tamm, vice president and president of Stanford University, has received the 1965 Wright Brothers Medal of Achievement for his "Outstanding service to the electronics industry as scientist, educator and counselor."

Samuel Kety, a physicist in the Electronics Department of The Royal Corp., has received the Group W Coldest Award from the Society of Photographic Instrumentation Engineers for "outstanding individual contributions to aerospace photonic instrumentation engineering."

INDUSTRY OBSERVER

Flight test plans for the Air Force Dyna-Star boost glide vehicle may be delayed by cost over-run affecting such key systems as instrumentation, guidance and communications. As a consequence of the cost deflation and resulting effects, USAF may not be able to meet its projected schedule for deep tests beginning in mid 1965 and orbital flights in early 1966 (AW July 12, p. 23). Aug. 19, p. 24). Stopped-up landing on a crash loss may be necessary to meet current flight test plans. Construction representing schedule difficulties—which apparently stem from program changes and forced landing—include Boeing, Martin, Electro-Mechanical Research and Radio Corp. of America.

Specifications for a reconnaissance version of the F-111 (YF-11) are being prepared by USAF's Aeronautical Systems Div. for a possible industry study program.

Federal Aviation Agency has awarded \$3 contracts to bid on development of an integrated sensor system for general aviation aircraft which would provide 360° communications channels, communications equipment, and ILS look-alike and glide slope in a package weighing less than 25 lb. and costing less than \$1,000. Prototype equipment is to be delivered within 12 months. Bids are due Sept. 25.

Program for General Dynamics/Aerospace SATAR satellite for aerospace research (AW July 15, p. 69) encompasses use of Allegany Ballistics Laboratory X218 solid propellant motor in the vehicle's autonomous rocket for propulsion into a 140-mph, 100,000 ft. Program was revised about \$2 million from USAF for one static test article and one satellite which may not be launched before the summer of 1964.

India has formed a government-owned company, Aeromarine India, Ltd., to manufacture Russian designed MIG and other types of aircraft and control and manage the complex of industries to be built by the government. Aeromarine Manufacturing Corp. at Kanpur has named one of its first two Aero 748 and two more are to be flown by March. Production will be about 30 aircraft.

An 18-month investigation of different electronic scan techniques suitable for use in several area surveillance modes which are hardened to withstand nuclear attacks is planned by Army Electronics Material Agency. Request for industry proposals is expected to be issued Sept. 9.

Railroad and first flight date for the North American B-70 Mach 3 bomber remain indefinite. Tightening problems continued to delay the recently downed August, but five are now expected to have been recovered. The aircraft were being checked last week, but actual testing of the wing to the fuselage had not begun.

Programs to develop advanced electromagnetic detection techniques for application to image amplifier sensor cameras to obtain image motion compensation control is being sponsored by USAF's Aeronautical Systems Division. Industry will submit proposals for the program by Sept. 12. Included will be the fabrication of a single broadband model.

Procedure to accomplish accelerated life testing of space guidance components will be established under a 30 month contract from Aeronautical Systems Div., proposals for which were submitted last month. Study is predicted on the system that a guidance system with 95% probability of successful operation for a one-year mission must have a mean-time-to-failure, assuming random time-to-failure distribution, of 171,000 hr. Demonstration of such MTBF in a real-time acceptance test would not be feasible.

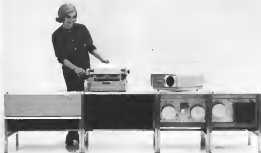
Study of phenomena of electrons at the metal-insulator interface of thin film composite systems will be sponsored by Aeronautical Systems Division. Also of interest, prototype, isolation methods, isolation mode and beyonds could well be involved in the investigation, for which industry proposals will be submitted by Sept. 11.



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Space Budget Attitude

Washington Roundup

Just change as Congress' attitude toward space budgets since last year was demonstrated last week by the House's passage of a \$5.3-billion NASA authorization figure agreed on by a House-Senate conferees (see p. 18). When the figure reached the House floor, an amendment to send it back to conference with corrections to cut the total to \$5.2 billion was defeated July 1 by a 206 to 176 vote. The bill finally was passed, by 215 to 215. As a result, last year's NASA authorization was approved unanimously.

Noting that vote was generally along party lines, with Republicans opposed. Five Republican members of the House's space committee—Rep. Richard Roussell (Ind.), Timmon Foley (Wash.), James Weaver (Pa.), Edward Gurney (Fla.) and Donald Rumsfeld (Ill.)—voted against the bill.

Report 56, Defense Dept.'s study of ways to place all military contract management under one head, has been completed. It would not centralize procurement, but would put all plant representatives and their support offices under a single defense staff and commander. Whether Defense Secretary Robert McNamara will go ahead with the plan probably depends more on his estimate of the congressional climate than on results of the study.

Russian Anti-Missiles

The present and former director of defense research and engineering are not concerned over indications that the Soviet Union has installed anti-missile satellites—what the Pentagon is now calling "anti ballistic missiles," or ABMs—in the area around Leningrad. Dr. Harold Brown, who holds the job now, and there is "evidence of possible ABM activity," but the U.S. does not consider it a threat.

Dr. Herbert York, Brown's predecessor, indicated a statement by Sen. Strom Thurmond that the Leningrad missiles "were capable of knocking down American missiles." Why, then, would Russia deploy such a potent Sen. Fred. Kocher said.

"Some of their scientists told them a ball of goods," York said. "That happens here, too."

Vice President Lyndon Johnson recently asked Defense Dept. and NASA for reports on what they are doing and what they plan to do about ensuring space stations—apparently to stress himself that the agencies are not dispersing study efforts. Analysis was classified, but the question squares whether new studies will be conducted for before current studies are evaluated. NASA has 13 or more under way now. Defense Dept. has been holding up Air Force requests for proposals on space station studies, which were due to be issued some time ago (AW July 8, p. 18).

TFX Cost Estimates

One reason why Sen. John L. McClellan didn't want moving the TFX investigation for a while was that he hopes to get hold of new cost estimates for the entire program. Estimates have increased significantly despite Air Force's insistence on sticking to the \$7.5-billion figure (see p. 18). Sen. McClellan would like to see the new estimates before he calls Defense Secretary Robert McNamara and Deputy Secretary Kenneth Gilpatric to witnesses.

The only Program Change Package (PCP) that has not been submitted to McNamara's office for approval is the one for the TFX. Critics want a complete and approved PCP 1 for use in preparing Defense Dept. a Fiscal 1968 budget request.

Proposed Federal Communications Commission procurement regulations for the Communications Satellite Corp. and its prime contractors (AW Aug. 15, p. 15), will be issued. McNamara contract was under which the contractor must certify FCC of the technical integrity and the procurement procedure used will be based from the original \$2,500 figure to \$10,000. An FCC spokesman emphasizes that the notification is intended only to assure adequate competition in major procurements, and not to involve the agency in the choice of contractors.

Life Among the Stars

Life Magazine and the 15 NASA space pilots are expected to sign a contract later this month which would give the pilots \$15,000 each for their personal stories, with payment to be made over a four-year period. Any new astronauts also would receive that fee.

Field Enterprises, which withdrew its offer of \$1.2 million for the package of personal stories because it could not agree with NASA on details (AW July 15, p. 25), still is looking for book rights.

Crossing the T

The 500-word statement that President Kennedy read on a closed-circuit television broadcast to the USAF-Lockheed C-141 rollout ceremonies at Marietta, Ga., recently (AW Aug. 16, p. 14) mentioned a broken Navy stringer, the late Alan Mulvan, and the Army's current chief of staff, Gen. Earle Wheeler. It did not mention the Air Force or Lockheed.

—Washington Staff



ALGOL ROCKET MOTOR, supplying approximately 100,000 lb thrust for the Little Joe 2 launch vehicle, undergoes static test firing at Aerojet General Corp.'s solid rocket plant, near Azusa, Calif. Note attitude chamber covering the nozzle end of the motor.

First Little Joe 2 Launched Successfully

Failure to transmit thrust appeared to be the only flaw in an otherwise satisfactory first flight test Aug. 25 at White Sands Missile Range of the General Dynamics/Convair Little Joe 2 launch vehicle which will simulate flight conditions to be encountered during actual Apollo missions.

Early acts of data indicated that there should be no delay in continuing the test program. Next tests at White Sands should be full short runs, involving launch of Apollo command module helicopters by means of the motor in the spacecraft's escape tower, and these will probably take place in the latter part of September. Little Joe

2 is thus scheduled to have two helicopter Apollo and one flight simulation mission apparently to test the escape system under maximum acceleration pressure.

Launch followed a fair 10-min countdown, with no holds encountered, at Area Launch Area I being used by National Aeronautics and Space Administration's Manned Spacecraft Center. The vehicle achieved programmed speed on the order of Mach 1.1 and a maximum altitude of 24,000 ft. Observers were "pleasantly surprised" at the lack of blast damage to the launch pad.

Program was to verify the performance of the solid-rocket-powered Little Joe 2 in flight prior to rejoining it to test Apollo command modules and the Apollo escape system under maximum acceleration pressure that will simulate short escape conditions after launch of Apollo using the Saturn vehicle at Cape Canaveral.

Test involved launch of a fully-powered Little Joe 2, with its 101,250 lb thrust Aerojet-General Algol motor and via 51,400 lb thrust Thrustol boosters being ignited at launch. Exact coordinates of Algol and Rocket motor to be used in future Little Joe 2 flights will depend upon flight requirements for each particular flight.

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APOLLO COMMAND MODULE helicopter, RF-6 (left), will be used to qualify launch escape system in all flight pad short test expected to be next in the program of White Sands. Launch can (right) path protective covering over window of launch escape motor.



Tapping the vehicle during its first test run on Apollo launch pad, consisting of a steel adapter 154 in. in diameter and 167 in long, a steel nose cone containing mainline 120 in long and 174 in in diameter of the base and a descent escape tower 55 ft high having total height of the vehicle and payload to 80 ft and total weight to 51,900 lb.

The test was to prove the assembly structural integrity, the vehicle's stability, propulsion system effectiveness and effectiveness of communications.

Plan was to accurately check after the vehicle achieved maximum acceleration pressure by sending a radio signal from the blockhouse which would indicate the Algol motor is having the desired system under two longitudinal cuts in the motor case. Pressure reduction of the signal being sent from the blockhouse was noted but the descent system did not function. As a result, the vehicle sustained about 47,000 lb downrange rather than the approximately 55,000 lb planned. Though analysis of data and vehicle movement was being made to evaluate the test completely and attempt to determine the cause of the descent system failure. About 100 sec of telemetry recording was achieved during the trial.

Walter Williams, MSC deputy director for mission requirements and flight operations, acted as flight operations director for the initial Little Joe 2 flight. Segments Sperry MSC Flight Operations Div. was test director. Launch was a Convair case consisting of test conductors J. Schindler, who actually launched the vehicle, and J. Lutzpeter.

German Plan Merger

Walter Flugzeugbau GmbH and Focke-Wulf GmbH of Bremen are now negotiating the merger of their development and production facilities before the end of the present calendar year.

The reason given for the impending merger is to achieve efficiency in all areas of operations. Weiss said that the move "is in line with the concepts of the appropriate German government departments" and "allows a merger in the international aviation industry."

Weiss will make a new stock unit with the share going to Focke-Wulf in exchange for the contribution of its facilities. Major shareholders in the new firm will be Krupp, United Aircraft Corp. and Focke-Wulf. The latter will continue to exist as a subsidiary company.

At the present time it is not clear how the merger will affect the Northern Development Group (ENDG), a Weiss affiliate and ENDG is composed of Henschel Flugzeugbau and the two winging firms.



Paraglider Evolves in Tests

Paraglider test model follows past above-mentioned successful model during wind tunnel testing at National Aeronautics and Space Administration's Langley Research Center, Hampton, Va. The model, which has been extending back 5 ft from the nose, was developed by Goodyear Aerospace Corp. under contract to NASA. The contract will develop an advanced model with remote losses under similar conditions. Preliminary studies indicate current losses will significantly increase range. Under these present conditions, the complete stated characteristics of the structure and its integration with operational Paragliders are being considered for use on the Gemini and Apollo space capsules.

OH-4A Finishes Contractor Tests

It Worth-Riddell Model 206 prototype of the OH-4A light observation helicopter has completed the contractor flight test program and is starting Federal Aviation Agency certification tests in its latest configuration embodying modifications aimed primarily at improved flight characteristics. Start of FAA trials came less than three months after the first Model 206 made its initial flight here.

Modifications include:

- Addition of a vertical fin above the tail boom (used) at improving static and dynamic directional stability.
- Cabin area has been lengthened by about 10 in to reduce drag and improve balance.
- Horizontal stabilizer has been moved forward 20 in to improve longitudinal stability.
- Nose-down external stiffener has been added at the junction of the underside of the fuselage and the tail boom.
- Air seats on the sides of the forward

portion of cockpit around the rotor mast have been deleted and replaced with seats in the front of the cockpit to improve airflow and transmission cooling characteristics.

Of the three Model 206 prototypes involved in the Bell test program, one ship has accumulated approximately 146 hr of ground testing and the other two a total of about 156 hr of flight time, which has included speeds up to 128 kt and altitudes of more than 15,000 ft. Machine gun and grenade launcher armament has also been fitted and checked out in ground and flight tests.

It is expected that FAA trials will be completed and two OH-4As handed over to the U. S. Army in the fall of the year for evaluation against a similar member of Helicopter OH-5A and Hughes OH-6A.

Outcome of this evaluation is expected to be action for about 4,000 LOAH helicopters with production starting in 1965.

Athena Rocket Launches to Begin In Air Force Re-entry Research

Washington—First of 77 Alouette is scheduled to be launched next month at White Sands Missile Range, N. M., in Air Force's advanced ballistic re-entry systems (AIRRES) program, which is designed to provide trajectory dynamics data on a wide variety of reusable re-entry bodies and configurations and

The program is part of USAF's 637A, on-entry research effort which also includes 30-30 flights of General Dynamics Atlas F boosters carrying payloads of new materials, nonrecoverable nose cones and debray and other penetration aids (AW Dec. 10, p. 17). The Atlas flights are being conducted from Affiliated Pacific missile ranges.

Phase 1 of the African rocket portion of the program was completed last month. It involved launch of 15 Nike Apache sounding rockets from White Sands and Wallops Island, Va., to check ground and flight instrumentation.

Phase 2 of the rocket program could be expanded beyond the 77 launches now scheduled. Total program cost through the first schedule is \$40 million.

Plan is to launch payload ranging in weight from 50-150 lb. to altitudes up to 500,000 ft. and then to dump them downward into the atmosphere at re-entry velocities up to 25,000 fpi. Design payload weighs 90 lb., and drops re-entry altitude a 250,000 ft. Re-entry angle will be varied from 15-45 deg.

Adverse Interactions

The Athena robot is being integrated by Atlantic Research Corp., which also is test conductor and facilities contractor for the phase of AIRS. The four-stage Athena has these characteristics:

- That first set, consisting of a Thetford NT313-28, Castro suggested to me Thetford NT419 (El Remonte). Castro has a 34,000-lb. diesel and a 30,000-lb. gas engine. The El Remonte is 14,000 lbs., and they both fit 7.5 sec. "Second stage will come in two configurations: an air-line-type refrigerator, a Thetford NT351-2, with a 63,000-lb. diesel and 37 sec. "The third stage will be a Hercules Alligatore Ballistic Launcher, NT270-A4, which produces 21,200 lbs. and has a 35 sec. burning time.

In a typical mission, the velocity package will be correct to altitude by the first two stages, which are engaged and fire-stabilized. The fins are canted to support a spin. The velocity package is updated while the vehicle is coasting to apogee. It is despin by means of a spin decelerator, patches over and is updated by means of a cold gas jet attitude control system. After burnout of the third and fourth stage motors, the re-entry shape and attitude decelerators are ejected and much more accurately at about 250,000 ft. altitude.

The payload is contained in an envelope 25 in. in dia. and 72 in. long. The four-stage, all-solid propellant Athena vehicle is 60 ft. long and has a pad weight of 15 750 lb.

Two Paths Forward

Two posts, with red lanterns, will be installed for the Arizona landmines. They are located near Green River, Utah, about 470 m from the impact point at White Sands. FFS-16 will not position back the vehicle during first and second stage burning and the launch site will be equipped with retract command capability because the vehicle flies over some sparsely-populated areas.

Air Force has modified K, C, and X band radars for in-matrix, in-ground measurements. These measurements also will be made on UHF, VHF, L, and S bands. A 24 in. gap for S-band Ranger radar and a 30 in. gap for combination L/UHF radar will be used for forest logging and are located at the southeast corner of the support rings. A smaller radar combination will be used for site logging from the southeast corner. Other ground stations will make measurements in the mobile and satellite transceivers.

An instrumented Boeing MC-135 aircraft, flying along the patrol trajectory, will measure payload signatures in visible, ultraviolet and infrared frequencies.

Affairs fundamentally is in the development of National Aeronautics and Space Administration's Titanides system, launch rocket program which utilized a spherical rocket in both fourth stage and payload to study, in order to detect, tracking, communication and nose cone rockets (AW Jan 16 1961 p 101). Titanides 2 had the same booster stage as Affairs. It also was recovered and fabricated by Atlantic Richfield Corp.

The Adiacas program is being directed by the Ballistic Systems Div. of Air Force Systems Command, through

BSI's Rocket Motor Re-entry System Office (RUC's) Space Vehicle Div., El Monte, Calif., will conduct the tests, which will use payloads provided by a large number of industry contractors. Other in the management structure are AvcoCorp., systems engineering, Lincoln Laboratories of Massachusetts Institute of Technology, consultation, Niles and Advanced Research Projects Agency, several experimental payloads, ARI, range support, and Systems Command's Electronics Systems Div., range communications.

Honeywell to Develop Passive-Scan Telescope

A powerfully-scanned star telescope for use on a small, space-stabilized rocket research vehicle will be developed by Honeywell under a \$69,200 contract from National Aeronautics and Space Administration's Langley Research Center.

The telescope will be used to determine instantaneous space-time effects with respect to celestial coordinates. It will detect the redshift from stars of third magnitude and brighter, and supply a coded electrical signal from which the position and the approximate photoelectric magnitude of a star may be determined.

The telescope will be mounted to the generic star-trail-parked counterpart of a four-stage, solid-propellant launch vehicle, and will observe out of the side of the rocket probe during a four-day mission. The non-guided launch vehicle will be spun stabilised at 680 rpm during the launch phase, and will be de-spun to 15 to 20 rpm before the data gathering period, which will occur at altitudes between 150 to 400 nm.

The span of the vehicle will mean the clearance field of view over a portion of the celestial sphere. A 3-m. clear aperture and a 30-min. 6-day by 6-day folded view will be required to obtain probability of star recognition and identification.

The star image will be scanned over a coded reticle located on the focal plane which will modulate the radiation received by a photomultiplier tube.

The telescope will be capable of operation under daylight conditions and will be fitted with provisions to shield it from sunlight which is not directly in the field of view.

Telescope aperture will be sealed by a blowout plug during the launch phase to provide protection from atmospheric heating and pressure debris. A flashing light source will be mounted at the rear center of the blowout plug to give a rough check of the operation of the telescope's photovoltaic power assembly before and during launch.



First Production F-5A Enters Flight Test Program

Two production reasons for the Norwegians' FTA efforts stand out. One is the production of fish as one of the primary exports. Improved strengthening of the wage and management of fisheries was required for the change, but the external platform across the issue. Low gasoline rates for production exports additions. Farmers across various strengthening programs. The production platform was the colored light of being in. Some referred to the outcome, as what U.S. citizens experience

News Digest

White House last week asked the Senate to confirm the appointment of William M. Hawken Jr., Lockheed Aircraft Co. vice president as assistant secretary of the Arms Research and Development (AWARD), Aug. 26, p. 24.

Minuteman ICBM launch, solid-propellant motor was successfully test-fired recently at Thiokol Chemical Corp.'s Winchell Dr. shot 32 months of sustained operational storage. The motor was stored at 70° ± 10 deg., with a relative humidity ranging from 40 to 45%.

Two Polaris A2 fleet ballistic missiles were successfully fired 40 min apart recently by the submarine USS *Alexander Hamilton* (submerged off the shore of Cape Canaveral, Fla.). The *Hamilton* was the 12th submarine to launch Po-

lets workers successfully drain the Atlantic Vasee Range. Next plans to conduct subsequent lineups from the Cape over north beginning next year.

Thiokol has received \$1 million and Aerojet \$1 million in follow-on awards for continued development in the Space's solid-propellant development program. Thiokol funding covers work on both 200-in. and 190-in. motors, and Aerojet's money is for the 200-in. diameter.

First Project Five vehicle package has been delivered to NASA at Cape Canaveral by Long-Tensor-Vought's Astronautics Div. Package will carry an Apollo-shaped Republic Aviation built payload, entire system being lifted some 510 cm by an Atlas launch vehicle.

Jet Commander has been placed on an ongoing flight testing at Edwards AFB including aerodynamic altitudes, calibration, full power thrust calibration, speed 14, power and fuel consumption trials. Prototype engine completed 82 hr of operation. Flight testing at its Northern Oahu base prior to being sent to the West Coast.

Goodwin has won a \$150,000 space agency contract to study and design a 50-ft inflatable lunar/terrestrial communications station (AW/MS, 12 p. 37). The Scout-launched vehicle will use ground stations for earth orientation, using three-40-ft beams, also inflatable, to strain stability.

Avon Corp.'s Research and Advanced Development Div. has secured an \$85,000 contract from the Jet Propulsion Laboratory to study three families of vehicle shapes for entry and landing on Mars and Venus.

BEA Shows Loss for Fiscal Year, Links Deficit to 'Social' Services

LONDON—British European Airways Corp., the state-owned heart and soul of the airline, last week reported a loss of \$742,000 for the fiscal year ended May 31, and blamed its inability to show an overall profit on losses in flying the so-called "social services" in Scotland.

Lord Douglas of Forth, BEA chairman, said BEA lost \$972,800 on its Scottish routes and again proved for a special grant payment from BEA to cover the social services.

However, it is known that BEA temporarily withdrew its application for subsidies until Ministry of Aviation and its members to see if a grant or subsidy is offered for Scotland, the routes should go on for holding by all British airlines.

Despite its overall loss, BEA showed a strong comeback from the loss of \$41 million in the last year. Lord Douglas, noting that the airline has earned \$98 million in the first four months of the current fiscal year, and BEA has budgeted for a profit of \$42 million by May 31 of next year.

The production followed an announcement by Ministers of Aviation John Acheson that the financial objective of BEA in the next five years, based on principles laid down in a 1961 government White Paper, was the return of autonomous airlines, not be in an average return of 6% a year as it did not after previous for depreciation but before taking account of interest charges.

Acheson said interest charges have a lot to do with the British Overseas Airways Corp., which is expected to report another large loss this year. Future plans for BEACW will be decided as a White Paper which will be presented to Parliament at the end of the current financial year.

In his report, Lord Douglas emphasized the airline's position:

- Net loss was arrived at after offsetting fuel authorization and depreciation of aircraft and stores and after paying interest on all BEA capital. Introductory costs of Virgin Atlantic partnership and the new Heathrow Airport 48 gate in the past two years amounted to \$17.5 million, of which about \$9 million was incurred in 1962-63. Of this figure, \$3.6 million has been capitalized and charged to expenses.

- BEA output in capacity two years next up in 1962-63 is 38.3% higher, revenue by 16.2%, so that revenue lost factor amounted at same level as in previous years.
- Due to a 10% reduction in operating

costs per capacity ton mile, the losses on long haul routes are reduced from 61.7% to 58.3%.

- Corporation lost about \$1 million in April and May of 1962 when airline electrification struck, forcing cancellation of more than 100 flights. Excess number of 1952-63 based cancellation of more than 1,000 flights. Due to both factors, plan change in passenger demand. BEA income fell short of budget by about \$16 million.

BEA earned total of 458,927 passengers during the year. Total revenue went up 9.6% to \$149.3 million but total expenditure increased by 6.9%.

Profit before taxation was \$175 million. Lord Douglas said BEA will increase capacity by 10% by 1965 and will provide 100 seats per aircraft.

TWA Develops Vane Straightener

Trans World Airlines has developed a new technique for working warped turbine nozzle guide vanes which it expects will save as much as \$800,000 a year in jet engine overhaul costs.

The system is the result of two years' research by TWA engineers, undertaken to prevent the discarding of vanes which warp after inspection to restore lost efficiency. Because of the toughness of the vanes used in its engines, no conventional method had been found for straightening the warped turbine vane. It has been estimated that replacement of warped turbine jet engine vanes annually total cost, from \$12 million.

Under the new technique, vanes are straightened by computer in the dimensionally overhead apparatus and, after cleaning, are subjected to controlled, clean, bend and heat. Warped vanes are polished in a diamond frame to fit new engine.

They are then placed in a die in a hydraulic press which is closed under 1,000 lb. pressure. An 8 lb. weight on the press is then released to strike the vane with sharp impact. Vanes requiring stress relief are placed in a heat oven for 2 hr. at 1,600 F.

Successful bidder for the press, which sells for \$55,000, was Product Development Corp. of Wichita, Kan. The firm has been twice awarded manufacturing and sales rights by TWA. Cost of this average \$100,000 and each one die is required for each engine stage.

Press has a capability of straightening an average of 30 vanes per hour at a total cost of \$2 each. During an over-

seen to 55 of the 58 stations on the engine's circumferential axis.

Navy de Havilland TWA will enter service next year, and Anthony Milward, BEA chief executive, last week and the airline will soon announce a further order for 10 of the larger Trident 1E aircraft. BEA now has 24 Tridents on order.

BEA's continuing warfare with Britain's independent airlines, and particularly with British United Airways, was underscored by Lord Douglas, who reported:

"BEA's future prospect of potential and profitable expansion could be completely destroyed by an airline homing in on displacing British services, either directly or indirectly. The evidence, however, demonstrates that an excessive degree of competition, in the form of parallel services on routes of inadequate traffic, is likely to result in a deterioration in the financial results of airlines."

last, an average of 300 cases per engine engine repair. Before the day of the present, new vanes had to be installed at a cost ranging from \$79 to \$151 per engine, depending on the engine, the vane represented approximately \$5,000 of the total engine overhaul cost.

TWA's research program was headed by J. F. Spaulding, director of gas turbine division, J. T. Koles, general manager, headed a machine shop group that developed the die.

In another technical development, TWA has improved turbine engine fuel by the Lockheed Maintenance Research Service on the carrier jet.

TWA has already evaluated the system in 100 hr. of testing on a Boeing 707 jet engine, and testing of a 1,000-hour engine is under way. The new engine program, says TWA will fully test contributions for installation of the system on all its jets.

During 1962-63, TWA's engine, instrument and flight systems performance, recording data conditions in a separate test. Lockheed Aircraft Service Co. developed the system, applying its own computerized data recording and plot-back equipment provided to it under license from Raytheon Instruments, Ltd., Boston, Eng. land.

TWA ground stations are being equipped with computers that will record data to a central computer system at the airline's Kansas City maintenance base. Personnel there evaluate the data and inform those where the engine is being tested of any required maintenance.

CAB Approves Pan Am-Qantas Joint Fare

Washington—Civil Aeronautics Board last week authorized an International Air Transport Agreement on international airline fares by approving a joint fare agreement between Pan American World Airways and Qantas Airways, Ltd.

Joint meeting from foreign criticism of its stand against an IATA proposed fare freeze on North Atlantic flights and promises to block any further proposals by the international group, CAB took "open rate" routes which has control over fares.

Two years ago the CAB Pacific by approving the past two applications filed by the two airlines as individuals.

Finding out that the open rate routes created because of IATA members' inability to agree upon a proper fare in the case, the Board and the Pan American and Qantas fare agreement set a rate similar to that already established by IATA.

In the North and Central Pacific area. Since the agreement was "apparently adopted outside the framework of the IATA membership" and filed by the individual airlines, CAB said it was subject to consideration under Section 101.20(b)(5) and 112 of the Federal Aviation Act.

Focus of the approved program is to reduce working fare for groups of 15 or more traveling together on scheduled air service. They represent a reduction of about 15% from the standard fare for those traveling between the West Coast, Honolulu and Sydney, Australia.

The Board said it intended the two airlines to follow required CAB procedures by asking permission to derive the fare proposal before filing an application.

The Board said it has encouraged a policy of such fare reductions, but warned: "We noted, however, in the future to withhold our approval and the subject matter of any such fare reduction agreement on rates and fares which we have previously authorized to the airlines leading to such agreements."

Boyd Favors Quality Competition Instead of Quantity in Some Areas

Washington—Alan S. Boyd, Civil Aeronautics Board chairman, last week gave some due to his thinking on the competitive problems facing the airline industry by stating that he is in good luck to see that quality competition is a number of airlines, not merely the number of airlines.

Turning before the House Aeronautics Subcommittee, Boyd stressed that the jet aircraft had changed the competitive picture of the industry and said new markets in the U.S. could be "well served" by low competition rather than three or more. He emphasized that the philosophy was to be used and that he had no idea whether the Board would agree with him.

During the hearings, Boyd again came under fire for his part in the early decision on the New York Florida-Kansas Railroad Case in which the Northeast Airlines operating certificate between New England and Florida was withdrawn (see p. 52). Rep. Torbert H. Macdonald (D-Mass.) charged that Boyd had "soured the death knell" for Northeast with the decision and charged the Board with inconsistency in reaching the decision.

In a hostile attack on the Board, Rep. Macdonald said that there were 25 other markets in the U.S. with three or more airlines. He charged the Board for failing to annul the

"new rule" he said and implied in its opinion in the Northeast case in respect to the effect on operations have on airline competition.

Boyd held that the policies of the Board must necessarily change from time to time, and noted that the structure for the Douglas DC-3 was entirely different from that which will be required when the supersonic transport is introduced in 1970. In his opinion, it is a change that the agency decision was a "disastrous" decision.

Boyd said the "status is your status set up in Congress. It is not my decision."

Rep. Macdonald charged the Board with a further inconsistency by noting that it had submitted a formula to the White House for a sharp reduction of subsidy (AW Aug. 18, p. 30), and then, on the same day, offered a \$1.7-billion subsidy to Northeast.

The CAB chairman, in answering the charge, said that the Northeast case "was outside the scope" of the memorandum for subsidy cuts.

Boyd admitted that the Board would have difficulty in revoking permanent certificates on other routes where competition is excessive. He added that, from a legal standpoint, Northeast held a prior claim to a permanent certificate on the New York-Florida route.

Pakistan, Red China Sign Air Service Pact

New York—Pakistan and Red Chinese governments last week signed an air service agreement between the two countries (AW July 28, p. 40).

In the pact, Pakistan would operate U.S. State Dept. suggestions that it not sign the agreement, which in effect provides Red China with its first access into the Asia area of Southeast Asia (see p. 14). U.S. government is concerned that the pact may be the first link in a route which could eventually reach into Africa and Latin America.

Pakistan International Airlines gets rights into Shanghai and Canton under the agreement, a routing it needs for service to Tokyo Service through China was sought after the British separately refused Pakistan landing rights at Hong Kong. The Communist Chinese airline, operated by the Civil Aviation Administration of China, receives reciprocal rights to operate into Karachi and Dhaka.

Pakistan plans eventual use of its Boeing 720B aircraft on the route, although this would mean runway improvements at both Chinese ports. However, Pakistan Vickers, of which the airline has three, could operate from existing facilities. The Chinese airline will probably by Viscount into Pakistan, having received five of an \$11,500,000 order for six Viscounts from the British.

Riddle Will Use Two DC-8F Jet Traders

Washington—Riddle Airlines has signed a lease purchase agreement with Douglas Aircraft Co. for two DC-8F jet traders.

Terms of the agreement cover a five-year lease of the aircraft and option and an option to purchase at price of approximately \$7,500,000 each, with monthly for previous lease payments made by Riddle.

Part of the two aircraft will be delivered in less than 90 days and the second is scheduled for delivery by March, 1964.

Riddle recently completed a \$2,600,000 refinancing program with Walter K. Heller & Company, Inc., and the Chemical Bank New York Trust Co., in cooperation with Douglas and General Dynamics Corp. The Miami-based, all-lease aircraft, has scheduled routes for military contracts which will total \$10,000,000 in fiscal 1964.

Early delivery of the first aircraft will make Riddle the first all-lease carrier to operate a jet service, President James B. Riddle said.

AIRLINE OBSERVER

SHORTLINES

►Time to increase tourism in Alaska by granting design flag carrier traffic rights in Anchorage on Tokyo-Europe polar flights has been launched by Sen. E. L. Bartlett (D-Alaska). Passengers are being the route on foreign airlines are not given stopover privileges in Anchorage, nor can these airlines pick up passengers for continuing trips. Sen. Bartlett has advised Sen. Bartlett that it will not be the action of U.S. carriers in the plan before reauthorizing the program. Last year Northwest voluntarily agreed a similar plan as a gesture that foreign carriers would draw traffic from the U.S. Japan North Pacific route.

►Several key airline industry officials are promoting Gordon M. Bess, Federal Aviation Agency deputy administrator, as a candidate for the top FAA post. Bess's handling of the supersonic transport program has made a strong impression in industry circles.

►New crew retirement policy at British Overseas Airways Corp. (BOAC) Apr. 22, p. 52) last week resulted in retirement of 39 captains, all in their 55th and most commanding BOAC's Bristol Britannia subsonic transports, which are being phased out. The 39 captains will receive such compensation and pensions. The airline and its total staff has been reduced by 367 employees in the last year. As of July, BOAC's work force totaled 21,365 employees.

►National Capital Airport bill, calling for the operation of Washington, D. C., airports as a corporation, has been signed by the House House of White House staffers over the objection to the bill of a provision requiring abolition of line and control between the corporation and airport authority. Provision was sponsored by the airlines. Speculation is that the White House forced the setting of a precedent that might spread to other agencies.

►National Airlines took first place from Continental Air Lines during the first six months of 1967 in utilization of turbine-powered aircraft. National reported a 58 hr 45 min average utilization per plane with its fleet of Douglas DC-8 transports compared with Continental's 10 hr 34 min with the Boeing 720 and 10 hr 12 min with the Boeing 727. Eastern Air Lines reported 14 hr 28 min with the Douglas DC-8 and 9 hr 14 min with the Boeing 720. No other airlines passed the 10 hr mark during the period.

►Wants for Eastern Air Lines to complete financing some with banks and insurance companies for its Boeing 727 order. The plan also will include arrangements for meeting or extending maturity of a \$20-million installment due this year on an \$80-million bank loan that is part of Eastern's current debt structure. Lending of some 727s is under discussion at part of the plan.

►Senate Commerce Committee met last week to prepare legislation that will give the U.S. control over international air lines. Sen. William G. Magnuson (D-Wash.) said the bill will be reported but showed signs that the act will be passed during the current congressional session.

►Wants for a several concerted drive by foreign flag carriers to prove that their investments in aircraft, engines, spares and parts largely offset revenues earned from U.S. air passengers to give the U.S. a highly favorable balance of trade in airline operations.

►Red China has asked Pakistan to ignore "U.S. detentions" of Pakistan's civil aviation policies. The weekly "Peking Review" said that "Washington's refusal to let us send Pakistani tourists" when a State Dept. spokesman openly expressed "disagreement" over Pakistan International Airlines' successful negotiations with Chinese authorities for a Pakistan-China air transport agreement (AW June 24, p. 40).

►Boeing Co. last week began a two-month series of demonstration flights with the Boeing 727 transport that will cover 40 cities in 25 countries.

►Pan American World Airways has reported a 35.1% share of transatlantic traffic for the first seven months of 1967, compared with a 27.9% share in the same period last year. Pan Am reported said the additional \$5,600 passengers provided an estimated \$17 million in revenues.

►American Airlines has begun construction of additional gates at its cargo terminal at Idlewild. Additional facilities also are planned for its cargo terminals at San Francisco, Los Angeles, Chicago, Detroit and Boston.

►Austrian Airlines has reported a 46% increase in the number of passengers carried in July, compared with the same month last year. Air freight in July increased 41% over the previous July.

►Civil Aeronautics Board will hold a special meeting Sept. 5 for a discussion between the Board itself and local service carriers on the abandonment of certain class subsidy rates.

►Continental Air Lines' three-class discount has been marked a success by the company after the first full year of experience with the plan. Carrier says revenue, passenger miles for the period rose 24% compared with the previous 12 months. Cash business class climbed 18% compared with coach traffic in the previous period, the airline reported.

►Finschild Straits Corp. is dismantling the company's latest production version of the 737 jet-propeller transport in Venezuela, Brazil, Uruguay, Argentina, Bolivia and Peru.

►Delta Air Lines of Spain has taken delivery on its sixth Douglas DC-8 transport. Carrier's testing fleet also includes six Sud Caravelle transports, which are used on its domestic and European route routes.

►Pan American World Airways will begin its fall and winter schedules on the transatlantic and transpacific routes about a single per capita average. Last Indian carrier flight will be reported Sept. 28 from London to New York.

►British Aerobics had its biggest monthly traffic volume in history during July when it "averaged more than 112,000 passengers daily," indicating a total of about 4 million passengers for the month. Goal for the year, which Aerobics will begin to achieve despite a helicopter fleet six months, is 55 million passengers.

►Trans World Airlines last week began showing movie pictures in the first class cabins of U.S. transcontinental non-stop flights. TWA has been showing flight movies on transatlantic first class flights for two years and in economy sections of these flights since May.

The DC-9 jetliner can improve the profit picture for airlines wherever routes from 100 to 1500 miles are presently being serviced by any other airliner.

First, it promises the same "jet attraction" which brought passengers flocking to the Big Jets when they were introduced. And it has the ability to operate profitably with fewer passengers than any of today's scheduled jetliners.

Airline key to small cities...Douglas DC-9



Second, it is designed for unsurpassed reliability and minimum maintenance. Every component has been carefully selected and tested for simplicity as well as efficiency. Jet engines are designed for long life and dependability. Highly accessible servicing areas assure quick turn-around and high productivity.

Third, it will be welcome at small city airports because its noise level will be lower than that of any jet transport now in service.

The DC-9 will carry from 56 to 83 passengers, operate from 5000 foot runways and cruise at 560 mph. It offers jetliner speed and luxury on short route segments where more than 60% of all passenger miles are now flown.

DOUGLAS
AIRCRAFT DIVISION

Airline Traffic—June 1963

	Passenger Miles (1963)	Originating Passengers (1963)	Revenue Passenger Miles (1963)	Revenue Passenger Miles (1962)	Total Revenue Passenger Miles (1963)	Average Over-all Load Factor (%)	Scheduled Flights (1963)	Profitability Factor (1963)
DOMESTIC TRAFFIC								
American	9,369	799 0	460,314	461 3	83,247	7 34	11,337	93 7
Boeing	3,373	317 4	109,339	207 9	13,207	4 72	2,473	93 4
Continental	1,187	118 0	41,416	31 2	13,494	4 46	1,187	93 4
Delta	4,454	420 1	203,748	60 1	39,368	9 99	2,354	93 4
TWA	9,716	817 4	399,748	50 3	42,129	4 91	8,756	93 4
Western	2,433	194 1	144,391	22 4	13,793	2 92	2,433	93 4
Northwest	1,372	117 3	22,087	22 4	3,103	4 50	1,372	93 4
Northwest	3,371	300 8	164,410	38 7	17,109	4 93	2,919	93 4
United World	1,611	142 3	614,396	68 3	9,373	8 373	1,611	93 4
United	16,319	1,186 9	852,715	49 0	90,023	8 04	16,319	93 4
Western	3,338	320 8	120,349	38 8	12,183	4 93	2,372	93 4
Domestic Traffic Total	63,748	4,879 4	4,400,424	56 3	984,343	4 99	63,722	93 3

INTERNATIONAL								
American	180	9 3	6,433	22 3	1,118	7 48	131	100 0
Boeing	376	8 4	13,343	11 8	1,736	4 42	141	93 4
Continental	140	49 3	3,444	41 7	436	3 71	140	93 4
Delta	109	3 3	6,809	44 8	463	4 13	109	100 0
TWA	100	80 4	97,072	60 4	9,344	7 79	1,073	93 4
Western	160	14 6	6,033	10 7	477	3 90	79	93 3
Northwest	107	34 7	43,419	18 8	9,406	9 46	914	93 7
United	107	17 3	10,092	27 9	9,794	9 18	107	93 3
United World	10,013	440 3	891,467	40 3	107,910	10 10	9,948	93 8
United	27	0 3	6,020	26 0	87	3 17	27	100 0
United World	214	12 8	10,030	48 1	3,468	10 30	244	93 4
TWA	3,447	40 3	817,804	14 4	24,401	9 20	2,434	93 4
United	839	10 1	72,544	4 3	8,619	9 20	103	93 3
Western	161	8 3	10,344	10 1	1,312	7 19	161	93 3
International Traffic Total	15,508	742 3	1,240,343	68 8	176,627	9 98	15,616	93 6

LOCAL SERVICE								
American	100	100 0	30,343	44 1	3,163	3 17	837	93 1
Boeing	499	40 3	17,312	89 3	1,108	3 20	390	93 2
Continental	100	24 6	6,899	45 3	787	1 46	100	93 3
Delta	954	43 7	13,122	42 8	1,391	1 47	923	93 3
Delta Central	276	42 3	6,812	41 8	728	1 27	276	93 3
Western	1,031	111 4	20,222	10 7	2,375	2 38	1,030	93 3
Northwest	100 8	100 8	1,000	43 8	9,098	1 54	1,041	93 3
United	948	21 0	10,419	26 7	1,454	1 45	149	93 8
Pacific	432	47 2	32,107	33 8	1,614	3 32	124	93 3
Rockwell	814	75 8	17,120	48 4	2,341	1 83	107	93 3
Southwest	841	32 3	10,847	37 7	1,643	1 36	100	93 1
United	414	54 7	8,466	43 1	966	1 14	637	93 8
West Coast	299	27 0	9,109	48 8	913	1 20	287	93 1
Local Service Total	10,386	776 8	146,352	47 3	17,404	3 78	10,179	93 5

AFRICA & HAWAIIAN								
American	157	7 4	6,110	41 0	3,342	2 88	129	93 9
Boeing	107	19 8	994	46 8	107	8 44	121	93 8
Continental	48	4 8	5,449	47 1	484	2 32	107	93 3
Delta	310	16 4	5,449	41 8	1,000	9 46	45	93 0
Western	138	4 8	1,051	41 8	1,000	9 46	45	93 0
Northwest	210	10 3	7,736	41 8	894	2 39	197	93 4
United	19	1 2	80	22 3	10	0 20	10	93 0
United World	171	3 3	1,816	42 3	260	1 44	104	93 4
Pacific Northwest	400	18 8	10,447	18 4	2,744	2 84	207	93 0
United World	19	2 1	1,744	96 3	91	0 60	47 3	93 3
Western & Alaska	33	1 4	87	77 0	8	0 20	15	93 8
West Alaska	290	8 1	3,244	41 2	225	1 26	193	93 3
Africa & Hawaiian Total	7,346	140 1	40,377	68 8	9,625	3 18	1,414	93 5

HELICOPTERS								
American	39	4 0	134	42 3	13	8 42	39	93 3
Boeing	67	14 9	634	43 2	46	1 52	75	93 1
Delta	42	31 7	406	41 3	59	1 19	42	94 0
Helicopters Total	148	47 7	1,274	51 3	138	6 50	156	93 2

CARGO & OTHER								
American	37	8 1	363	73 7	36	0 88	14	93 4
Boeing	1,107	9 6	40,018	84 2	17,474	16 77	263	100 0
Delta	196	3 1	4,464	92 9	6,464	19 14	196	93 4
Western	407	7 9	28,779	97 8	30,231	16 83	233	93 4
Wick	183	1 8	3,832	79 7	8,843	12 83	187	93 8
Cargo & Other Total	5,311	38 5	81,996	93 3	43,430	18 82	1,094	93 4
Industry Total	87,766	4,848 7	4,690,146	29 5	426,616	8 91	50,616	96 8

Reported by Ray S. Fox



Boeing Aircraft Corp.'s BAC 111, which took its maiden flight recently at Hove, England, was recently shot (AW Aug. 26, p. 39) in down (above) in BAC 111 chief pilot C. R. (Jack) Bove taking the aircraft into a go-around at about 3,000 ft. Gross takeoff weight was 18,000 lb. Tailhook-like extension from the fuselage is a presently warning not to provide support warning of imminent a two-step.

BAC 111 Shown in First Takeoff and Approach



Starting (above) with takeoff flap setting of about 24 deg., BAC 111 began 27-min. maiden flight. Note right upward deflection of the elevator as aircraft's moving flap phase. Landing (below), BAC 111 is shown crossing the runway threshold at Hove, prior to full flap touchdown. Note Hove's second phase in background. See BAC 111's will soon enter a flight testing and certification program.



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SPACE TECHNOLOGY

DDR&E Ponders Military Comsat Future

By Irving Stone

Los Angeles—Future of the military, nonclass-airframe communication intelligence (MACS) will be charted by the impending decision of Dept. of Defense Research and Engineering (DDR&E), following review of the program's Phase I results.

Interested industry and military personnel see three possible courses:

- Approval for development and production of the satellite as originally planned on the Air Force Space System's Defense Program 306, a quickly-mountable, nonclass-airframe, nonclass-airframe communication satellite.
- Reorientation of the program to include state-of-the-art advances in order to attain satellite techniques.
- Cancellation of project to rely on the means with the NASA Hughes system to achieve state-of-the-art communication satellite (AW Aug. 19, p. 73).

Apparent even that DDR&E may follow either of the last two. It is felt that nonclass-airframe inclusion at advanced state-of-the-art will reduce the projected 1967 operational target date and reduce the size of the program. Cancellation, these sources feel, will permit a promising and successful package for what they believe is the more complex, expensive system with its difficult trajectory and much later operational date. Both the nonclass-airframe and nonclass-airframe systems are regarded as necessary, at least in the

early stages of space war, either as an early and reliable network.

The issue first appeared in the General Electric Monitors and Plans/Space Technology Laboratory studies, which completed the Phase I program definition and performance design on Aug. 1, have been evaluated by a group composed of three Air Force officials and one Aerospace Corporation manager, and by subgroups composed of Air Force and Aerospace personnel. Findings of the evaluation group have been submitted to the source selection board, composed of four military officials of two-star rank, and a civilian of one-star rank.

2. This is being followed by review of the evaluation findings and the contractor selection by Air Force Systems Command, Air Command, Defense Communications Agency, and DDR&E. Final review and decision is expected to be made at White House level.

A decision on the course of the program will be firm by mid-September, with Oct. 1 as the go-ahead date

for development and fabrication of the original program plan is followed by Monitors, Plans and Production program under Phase I work. Several development of hardware for a significant program projected for use in extensive studies of the system, either as a satellite, either as a satellite or as a ground-based system.

MACS would be the first communication satellite system, as opposed to a nonclass-airframe satellite system.

- Approximately 50 to 75 satellites will be built initially, with perhaps 15 satellites per orbit substituted into the program as required.
- Satellite replacement, depending on whether selected, might be a nonclass-airframe or a classical system type. The satellite's largest commonality will not exceed 3 ft. Solar cells would be used in the solar array.
- Satellites will be deployed in two polar orbits and the system is projected to give 99% availability of communication between critical military sites.

• The satellite disposal will not exceed 100 to 150 miles in the orbit. The satellite disposal will not exceed 100 to 150 miles in the orbit. The satellite disposal will not exceed 100 to 150 miles in the orbit.

• The satellite disposal will not exceed 100 to 150 miles in the orbit. The satellite disposal will not exceed 100 to 150 miles in the orbit.

• MACS will be operational and will be fitted with a double antenna system directed in one plane and with about a 45-deg. earth-cone in the other plane.

MACS has been projected entirely as a critical-the-art program in most cases. It is considered a product, but critical requirement for military global communication. From approximately May 1961, until early January 1965, Aerospace Corp. is responsible to the Air Force's Space System Div. for the program's general technical direction and system engineering. Planned the MACS system, its engineering, its design, its development and other factors in keeping with existing technology. Aerospace is also responsible for the construction to ensure that detailed fabrication on the basis of existing state-of-the-art would be achieved.

Industry feeling is that trying to keep up with the state-of-the-art during a program with a definite goal results in substantial data and additional expense and, frequently, confusion. Aerospace officials after one program is finished, to begin to look at the state-of-the-art. By the end of a one-to-two-year development period the state-of-the-art may be deemed substantial. The critical question is whether the level of technology to be attained at the end of a specific development period is adequate to meet the program requirement initially established.

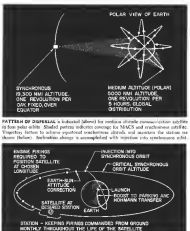
MACS Reorientation

DDR&E may reorient the MACS program to include a state-of-the-art advance by introduction of a ground-based communication system on the basis of work done recently by Navy and John Hopkins University's Applied Physics Laboratory with a Transmitter on the launch on June 15. It is not clear if the system of 15 satellites and a network of 120 ground stations is a 100% solution or 90% and some more.

Whereas the Navy/APL experiment indicated a trade high advantage effect to achieve autonomous capability, the results may not have been as successful as anticipated and references could be included into the Navy program to provide ground-based capability.

Both DDR&E and NASA are considering advantages of conducting experiments to apply the ground-based technology for service in a satellite system of higher altitude than the Navy satellite, which at the 5,000-mile level would be about 15 ft.

• Early operational target (1965) for MACS is tied to the use of an atmospheric general system, either as a backup or as a primary system.



program advance proceeding with the program as originally planned, with ground-based communication satellites placed near the launch, as a program to be developed without disturbing the time schedule for MACS, which will then plan to use a ground-based system to maintain the station as shown in the diagram. The ground-based system will be used to maintain the station as shown in the diagram. The ground-based system will be used to maintain the station as shown in the diagram.

Orbital Weightlessness: By contrast, in the configuration would be weightless and the gravity gradient effect would be minimized. If, however, the two-bell configuration were given sufficient length it would be possible to establish a slight difference in "weight" of the two bell ends, because one end would be appreciably closer to the center of the earth than the other. Result would be that the ground would be in a slighter position and slight shift in the local normal. A damping device also would be needed to maintain performance

DOD Denies Comsat Change Plan

Washington—Defense Dept. is denying that any change in contemplated in the present configuration of the military communication satellite system.

Nearly five months ago, the Pentagon suggested that General Electric and Philco-Ford in the program develop space studies, including the possible possible position of a satellite using ground-based satellite technology. The Defense Dept. recently has asked the National Aeronautics and Space Administration to evaluate the technique at an altitude of 5,000 mi. to determine its effectiveness for a space communication system.

It is not a technique in development, according to a Defense Dept. spokesman. It is not with to occur until after several down nonclass-airframe communication satellites already in orbit is used to delay the system in establishing additional nonclass-airframe technology before the military satellite launch, already planned. Military satellite operations may be possible. Pentagon staff is a communication system may have evolved from public statements by DDR&E officials indicating that the climate satellite system is likely to be a combination of both nonclass-airframe and synchronous orbit and the recent success of the NASA-Hughes System 2 synchronous satellite.

An additional launch over the present orbit-synchronous satellite system communication system is the question of how much more will be authorized by Congress for Fiscal 1966. Level of funding possibly contemplated by Congress which is below that requested by the Pentagon for the satellite orbit system, at present to delay first launch of the satellite system by next year. If Congress should authorize for more money than the Pentagon has asked for, the system might be used for a synchronous orbit, but this possibility, some sources,



Fig. 12 Channel SSB Duplex Multiplex Set

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Industry's only solid state multiplex equipment designed expressly to meet airborne military specifications

Now, for the first time, solid state multiplex equipment has been designed from the ground up to meet the requirements of MIL-6-60300 and MIL-6-7592. This equipment is now available in basic 12 channel "building blocks".

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[A typical application is the 60-channel AMACC-3, now in production by EC1 for the U. S. Air Force. It is 1825 pounds (72% lighter and 60 cubic feet (60%) smaller than functionally identical existing military equipment).]

The new multiplex equipment, capable of handling voice, teletype or high speed data, is the result of company-sponsored R&D by Electronic Communications, Inc. EC1 has taken full advantage of latest developments on the state-of-the-art—redundant circuitry, miniature tube design, high density cardboard packaging, and solid-state circuits throughout. The result is a highly reliable multiplex system that—in its basic 12-channel format—occupies only four cubic feet and weighs only 350 pounds. Channel quality meets the highest standards.

The EC1 multiplex set can provide high volume channel capacity through stacking of the basic 12-channel modules. In any application, equipment may be grouped to fit available space.

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effects which otherwise might cause the satellite to tumble.

The use of the gravity gradient restoring force that would cause the satellite to swing itself along the vertical at 5,000 feet or so was about one-tenth of that present in the 400-foot air altitude of the Navy satellite. Industry members close to the MACS program feel that it would be safe to re-start the program on the assumption that the Navy-APL system would be effective at high altitude in the degree demonstrated at the low altitude.

Spin-Stabilized Satellite

It is felt that the MACS program itself proved self development of a spin-stabilized satellite to meet certain communications needs in early 1965. The MACS multiplex equipment could be modified without difficulty to accommodate a gravity gradient stabilized satellite for comparison to MACS in the same mission. If the stability of the technique for the deployment altitude were established, the gravity gradient-stabilized units could be used to substitute for spin-stabilized satellites which come to function in the MACS orbit. With successful gravity gradient stabilization established for MACS, its communications capacity would be increased many times because of the antenna gain.

Proponents of the MACS system feel that successful achievement of Systems of synchronous altitude and in-phase-point transmission might also in the DODIG review, the attractive features and relatively high availability of MACS for the satellite, to the extent that its development might be considered in favor of a satellite synchronous satellite system.

Katzen Plot

The synchronous system operating at an altitude of 29,000 miles has a period of rotation dependent on one orbital day. If the orbit is in the plane of the earth's equator, the satellite appears over a fixed point on the earth's surface and, in effect, serves as a fixed relay tower. Ideally, three such deployment orbits, spaced 120 deg apart, would afford almost worldwide communications.

Concept of a satellite which means fixed relative to the earth appears to offer greater flexibility and more communications capacity than the MACS system, which is in the replacement of tracking and the need for ground stations to change from one satellite to another as they pass overhead and appear and disappear over the horizon. Both systems could be used together advantageously, it is felt, with ground stations operating for either or both of the systems.

Ultimately, limitations imposed by longer capabilities and satellite reliability



SATELLITE STABILIZED with gravity gradient torque (right) would correct excessive rotation capacity because rotation axis is forced only by angle introduced by earth.

will diminish to an extent that would make the synchronous system the preferred communication technique. With the introduction of big boosters such as Titan 3, it will be economically feasible to orbit satellites of substantial weight, and attendant communications capacity. Large payload capability also will permit the launch of multiple satellites, to make deployment of an operational synchronous system more attractive economically.

Reduced Requirement

Use of the MACS system in comparison with a synchronous satellite arm could work to reduce the number of satellites required for each system. Estimates are that while, from a geometric aspect, each three synchronous satellites would be needed to cover most of the earth (except for polar regions), a single failure in the synchronous system arrangement would result in a gap in communications capacity for as much as six weeks, considered to be the maximum time for a launch pad to put a replace spare satellite in orbit.

This means that a minimum requirement would be two satellites at each synchronous station, or a total of six satellites to ensure communications reliability. If additional coverage were required for specific polar regions—and it is estimated, especially from a military support—another pair of satellites might be needed at specific longitudes, increasing the system requirement to eight satellites.

Another synchronization estimate for a synchronous system, with adequate allowance for failures and long replacement time, indicates that 9 to 12 satellites would be required.

The synchronous system orbit, the booster and possibly a first burn of the second-stage would be used to inject the satellite into a parking orbit. This would be followed by second stage second burn for a Hohmann transfer orbit with apogee at the synchronous altitude. Here, a third burn changes inclination to the equatorial plane and circularizes the orbit.

Placement of a satellite at a specific longitude around the equator imposes another complication in attainment of the proper orbit. Also, still, consideration of the gravity gradient effect in the equator makes it necessary for a synchronous satellite to be fitted with station-keeping equipment.

One approach to attainment of synchronous orbit at the first apogee burn is to use a speed deficiency which puts the satellite into a slightly elliptical near-synchronous orbit. Successive burns appear to "walk" the satellite around the near-synchronous orbit because of the relative motion of the earth. These successive burns raise the perigee and finally place the satellite into synchronous orbit at the desired longitude.

Launch Requirements

Estimates of launch requirements for establishment of the synchronous altitude system and the midday shuttle system indicate a favorable advantage for the latter. Comparison of a six-satellite synchronous system with 15-year mean time to failure, one satellite per launch and pad turnaround time of about one week, with a 15-satellite MACS system with a three-year mean time to failure and eight satellites per launch, indicates that, for as 90%

Fubini Urges Military Space Role Analysis

By Philip J. Khan

Washington—Critics of the Defense Dept. policy on manned military space programs have been challenged to explore and demonstrate a useful role for military uses in space by means of simulations and tests conducted on the ground and from aircraft.

The new Pentagon approach to manned military space programs—which does not, however, represent a basic change in philosophy—was revealed by Dr. Eugene Fubini, who recently was named assistant secretary of defense for research and engineering. The speech made him recently before the "General Rocket Club," now Fubini's first since he became assistant secretary. He, however, was deputy director for research and information systems.

Mission Analysis

"What is needed," Fubini said, is not the conception of new roles for military observers in space but a thorough study and evaluation of those which have already been proposed. Some questions in which man might exceed unmanned satellites "include reconnaissance, intelligence gathering, warning and perhaps repair. As technology advances, man might play an important role in recovery of spacecraft and hardware," he said.

"It can be no man's job that is man's own performance in those roles better than

a machine, but I am also not sure that he cannot," Fubini said. "We should assess these men by comparing their functions, modeling them, and trying them on as carefully as on the ground."

If the results look good we can take the decision to go ahead with space tests."

Asked for specific examples, Fubini said it has been suggested that "overall reconnaissance" from space might be a useful military function. But he noted that practically all of the Air Force's secret reconnaissance work is done by camera. He suggested that tests be conducted from aircraft to determine what useful military information can be obtained by "overall reconnaissance," and how difficult it is. For example, for a man to keep a telescope pointed at one particular spot on the earth.

Presumably, the Pentagon might apply the same philosophy to the question of manned inspection of unknown satellites to determine their possible hostile intent. For example, fly-by tests could be conducted using aircraft to determine effectiveness as a function of closing speed. Usefulness of physical contact with the unknown satellite might be evaluated in a ground space chamber, using a man in a space suit to evaluate functions of satellite models.

"We must not let our devices and work harder to validate the means for

and feasibility of manned military space missions," Fubini said.

Fubini pointed out that space tests are the expensive way to conduct preliminary investigations which can be carried out on the ground or in the air. Manned launches in some future programs are expected to cost as much as \$40 million per shot, he said.

Fubini expressed concern over contracts awarded for the study of manned spacecraft "with no concept whatever as to what equipment we are going to get in there." He said it is not necessary to begin the design of an airplane without first determining its intended mission.

Current Programs

To those who charge that U.S. has "not a single military space program," Fubini cited current efforts in reconnaissance, communications, weather, navigation, guidance, inspection and intelligence gathering satellites. "We are doing a pretty good job in many of these," he added.

The only military space project that has been proposed with any degree of definition that is not being supported today by the Pentagon, Fubini said, is the suggestion of placing a man in orbit.

"I don't see why anybody should be man worried about a launch brought down from orbit into the U.S. than



... payloads or promises?

On the front line, the need for supplies is urgent. To fulfill that need, LTV teamed with Hiller and Ryan to develop the KC 142—the first and only V/STOL aircraft with payload capabilities for operational missions.

Rather than a V/STOL prototype based on unproven new concepts, the KC 142 was conceived as a four engine turboprop transport capable of moving 4 tons of cargo at 250 kts. A bit wing design with deflected slatman gives it the V/STOL capability it needs.

This no-nonsense approach to the problem has produced an aircraft with the ability to take off vertically, carry an 8,000 lb payload to an unprepared site, hover ten minutes if required, land and offload, then take on a 4,000 lb. cargo for the 300 mile trip home. It can be ferried 2,500 miles at 25,000 ft and 240 kts or carry a 20,000 lb payload 400 miles in conventional flight configuration.

Basic design on the KC 142 is complete and the first flight is scheduled for summer of next year—an aircraft ready to deliver payloads, not promises. Chance Vought Corp., Aerospace and Missiles Division P. O. Box 9907, Dallas, Texas. A division of Ling-Temco-Vought, Inc.

LTV LEADERSHIP THROUGH VERSATILITY



GE Studies Thermionic Auxiliary Reactor

Avoid operation of General Electric space thermionic auxiliary reactor (S1 MR) being studied under a \$65,000 contract from the Air Force Space Command's Weapons Laboratory. Design consists of electrical discharge-type diodes around the reactor. A common vacuum tube is shown protruding from the outer surface of each diode. Power output of 100 kw with a specific weight of 15 lb/kw for 100 days may be possible, according to GE. High operating temperature enables elimination of coolants and reduction. Power plant operating in space may be accomplished by using heat loss to the vacuum and positioning the wall of the reactor to achieve conductivity. As a safety precaution prior to launch, the powerplant would be divided into two spherical parts. Double chamber temperature is about 3,000°K, gas collector temperature is about 2,000°K.



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SURPRISE PARTY

Three planes had left Belfort, France two hours before. It was 12 a black straggle up, November 21, 1914. The visitors to this northeast shore of Lake Constance, near the German city of Friedrichshafen, came uninvited. Their sight—destroy the hated enemy Zeppelins—inspired in giant wooden sheds.

Preparations for this surprise visit began almost a month before. Lieutenant Pemberton Billing of the Royal Naval Volunteer Reserve arrived in Belfort from England on October 24th to plan the raid.

Belfort was crawling with German spies. So arrangements were

made to bring in the British pilots and planes secretly at night. The pilots would hide in a dirigible shed until the moment the red was to begin.

Once the plan was arranged, Billing drew up a flight plan and detailed map of the Zeppelins complex. The French wanted a crash at the Zeppelins, too. But they negotiated to the Royal Naval Air Service. After all, these Zeppelins were meant to destroy the British fleet.

On October 26th, Billing returned to England. He picked four pilots for the raid: Squadron Commander E. F. Biggs, Flight

Commander J. Y. Balmington, Flight Lieutenant S. V. Blythe, and Flight Sergeant E. P. Gosses.

The planes they were to fly were Avro 504s. Powered by an 80-hp Gnome rotary engine, the Avro 504s was used primarily as a trainer, yet it was considered good in its contemporaries in design, construction and performance.

Four Avro 504s, four pilots and 11 mechanics arrived secretly in Belfort on the night of November 19th. But on the morning of the 21st, only three planes took off. Gosses' Avro broke its undercarriage and was grounded.

Biggs, Balmington and Sippie flew the 125 miles to target a few miles from Belfort. They first went northwest above the Rhine to Schaafhausen, then doglegged to the right to Lake Constance. They carefully avoided Switzerland's restricted air space. Arriving at the lake they flew a course 10 feet above the water.

Five miles from Friedrichshafen, the pilots began climbing to 1000 feet, then dove to 100 feet and dropped their 20-pound bombs on target. They turned back and forth so fast, that the hundreds of panicked soldiers and civilians on the ground thought there were six of them.

While the bombs were dropping, attack shells fell around them. The Germans kept up steady machine gun and rifle fire in spite of the panic. Sippie made two direct hits, one on the gas works, the other on a Zeppelin shed. When his fourth bomb failed to release, he bailed home for Belfort the same way he came.

Balmington dropped his bombs with equal damaging effect and followed Sippie back to Belfort.

Biggs wasn't so lucky. The machine gun enemy fire forced him to land near the Zeppelins works. As soon as he stopped, an angry mob of Friedrichshafen citizens dragged him out of his plane and carried him off to be lynched. But German officers, rescued him and brought him to the Weingarten Hospital in Friedrichshafen. Surprisingly enough, the German military treated Biggs like a hero.

The three damaged planes did extensive damage. Three bombs hit within an area of 700 square yards and around the Zeppelins sheds and gas works. One Zeppelin was almost completely destroyed, others were seriously damaged. The gas works lost thousands of cubic feet of precious hydrogen in an explosion which sent flames hundreds of feet into the sky.

As a result of this one raid, the Germans went to great pains to guard Friedrichshafen from further attacks. The Bavarian regiments and night watchmen were doubled in strength. Five anti-aircraft guns and machine guns were set up. Powerful searchlights were installed. A strict curfew was also enforced. And two more gas bombs were stored on

the floating Zeppelins shed on the lake. But Friedrichshafen was never attacked again. And all these preparations were in vain. The Germans should have figured there wouldn't be any more such, though. After all, a surprise party isn't a surprise party if people know you're coming.

It's a long leap from Zeppelins to satellites, isn't it?

A gentle leap. Mrs. Bill Biggs, Balmington and Sippie probably didn't dream of the strides that have been made in the last 49 years.

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about a month launched by an RCIM (from a pad in the San Joaquin). "I've been told" "For a given booster the size of the bomb is larger in the RCIM, the accuracy is greater, the possibility that the intended run be given in a trench location is higher." "I've been told" "I would rather than strengthen his position. This is no clearly, so also risk a long strategy that no subject that was not have no doubt about the (reduced) strategy." However, he acknowledged the possibility that an orbital weapon might have some pre-emptive impact on his knowledge of the position.

In reply to those who suggest that a thermonuclear weapon exploded in orbit could "win" major U.S. status, Fehrs said that that outlandish idea it is possible to complete that a 2,000-megaton bomb would be needed to set fire to France (about 100 miles of 150 mi). Such a bomb would weigh "hundreds of tons," which is far less and the capabilities of any existing booster. To do this, New York, by plane would take as 8,000 megaton warhead. Fehrs said, requiring a booster capable of putting "over many hundreds of tons in orbit" and a booster "100 tons" more than the current approach. The Soviets have not launched "I certainly will not propose that we race headlong into the development of an offensive bomb-in-orbit program," Fehrs concluded.

Orbital Guidance

Concluded, Man-Avion Corp's Research and Advanced Development Division, Washington, Me., is studying a passenger orbital guidance system utilizing continuous looking in orbit at a planet in the orbital plane of an interception trajectory.

Difficulties in knowing the atmospheric density of major planets results in large uncertainties in the density of objects, characteristics of planets such as Mars or Venus as well as the conventional interplanetary had experiments for measured orbital objectives.

The Avion guidance orbit guidance system depicts line or five 4th order orbits to define the density orbit or orbit in orbit 2:5 deg. The precision would pass through the planetary atmosphere, either impacting or skipping out prior to spacecraft exit with a controlled range of rate coefficients.

"Twenty days it is relayed from an orbital accelerometer on each planet. The spacecraft computer receives the information information and can then determine an appropriate adjustment to the quantity velocity vector to give favorable actual conditions upon entry into the atmosphere."



PILOT DE HAYWARD DH-125 is to be delivered to a customer in this aircraft, owned by Bristol Siddeley Engines, Ltd., builders of the two Viper 20 powerplants. The plane is to be used as an executive transport and is a flying testbed for work on engine improvements.

Aviation Week Pilot Reports

DH-125 Stresses Operational Simplicity

By Herbert J. Coleman

London—De Havilland Aircraft—scarcely conscious of the development cost in DH-125 holds over the real Dassault Mystere 20 executive jet transport—a accelerating flight testing of the DH-125, an aircraft that should pose no problems for pilot theorists from piston power to jets.

With four places now flying, and a fifth due to roll out in November, the development test team is concentrating on operational simplicity, aiming at ease of handling but meeting the "lighter type" of control on the basic theory that the DH-125 is a light transport and should be flown as such.

One technical objective has been a considerable lightening of aircraft loads, a vast improvement for pilots who had complained of heavy handling characteristics in traffic patterns and other maneuvers.

Another important emphasis is on flight safety. De Havilland has developed a thrust sensing device which automatically compensates in engine detection if an engine loses power (AW July 3, p. 25).

In other recent notes:

• De Havilland has proposed talks with Bristol Siddeley on the possibility of developing the Viper 20 powerplant into an off-line version which could also compete with the General Electric CF-700 turbofan engine powering the Mys-

tre 20 (AW Aug. 12, p. 43). So far, the talks have not determined who will pay development costs, although Bristol Siddeley has indicated that it would fund the program if a firm, long-range order were in sight.

• Mark 2 version of the DH-125, a slightly larger version featuring an aft fuselage (with the CF-700 not completely ruled out) is in an early stage of development under the direction of Chief Designer G. T. Williams. The version also would include increased fuel tankage.

• Bristol Siddeley is working on another version of the Viper 20 which, by running hotter, would allow better DH-125 field performance at high-altitude airports and in hot climates. In effect, the engine would hold its thrust rating to 5,000 ft (350 ft/min GPH), obtaining the present maximum for floating both during the climb. The project involves considerable exploration in high-heat metals.

Since taking delivery of its own DH-125, Bristol Siddeley has become closely associated with De Havilland in a flight and ground noise reduction program.

The engine company is working on housing modification and inlet case design to cut noise during taxing. The aircraft itself has been soundproofed about as much as possible, according to Williams.

An early problem of high noise level in the cockpit has been solved by ad-

ding a bulkhead between bulkhead and cockpit.

On production version, the bulkhead will be replaced by plastic, and will also house radio antenna.

Williams said the company has dropped plans to reengineer the Mark 1 DH-125 with the CF-700. The main reason, and one that spread importantly in talks with Pan American before that airline ordered 40 Mystere 20s (AW Aug. 12, p. 43), is that engineering costs to use the G. S. powerplant would have been about \$1.5 million. Williams said the aft fuselage and tail section would have been redesigned and the time involved would have apparently cut the DH-125's lead time over its competitors.

Before of this concentration on producing and advancing the program to work certification, the company has decided not to exhibit the executive jet at the National Business Aircraft Association Sept. 24-26 at Houston, Tex.

However, Transair Aviation, the Canadian distributor, will show a full-scale mockup and a full-scale model will fly from England to attend the show.

Flight characteristics of the DH-125 were reviewed by the Avianus West & Sonar Testpilot as a series of flights from de Havilland's own production plant at Hatfield, England. The first flight was cut short when the left Viper 20 failed to ignite after a



DH-125 TENDS TOWARD first approach to landing, due to except wing. Pilot does not have to begin descent until reaching the runway lip. The aircraft requires a short ground run after setting on its main gear.

deliberate shutdown at 35,000 ft., due to an ignition plug failure.

After a flight in the No. 1 airplane, GARYA, in which altitude control was decided, on, another altitude flight was made in the No. 2 DH-125, registered GARYB and fully instrumented for altitude load and flutter tests. The pilot at command was Geoffrey H. Pike, development test pilot, flying in the right seat. Weather was good, with about 9 1/2 ft cloud coverage at 4,000 ft., and surface temperatures of about 61°. Wind was from 280 deg. at 15 kt.

Engine starting is accomplished after the usual external visual checks are com-

pleted and the main entry door has been closed and locked. Thrustors are closed and low-pressure fuel cocks opened. With the No. 2 engine high pressure cock and fuel pump on, the starter is operated until a "biff" light goes out and jet pipe temperature and gas temperatures are in the green. The same procedure is followed for No. 1, the cabin altitude switch is set to manual for check-out, and then set to automatic for the remainder of the flight.

Low altitude and high gear while taxing can, and fast, nose wheel steering is controlled by a wheel on pilot's side

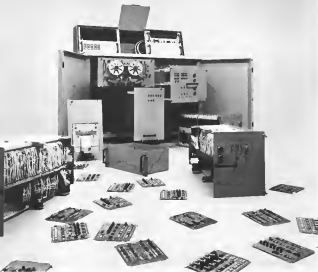
and allows turning on grass and rough surface a practice that is common at Hatfield.

Lined up on the active runway, brakes are set and the two Vipers run up to 100% power before the brakes are released. Acceleration is fast, and deceleration control is maintained by manipulation of the nose steering wheel and about 50 ft., when altitude control becomes available. Takeoff flap is set at 15 deg.

The DH-125 rotated at about 70 ft. and was airborne at 57 kt. Flight speed built up quickly after the gear and flaps had been retracted and climb power



FIRST FOUR DH-125s are lined up on the ramp at Hatfield. The fifth aircraft will be rolled out as November. No. 1 aircraft, GARYA, is at the right in photo, with the second, third and fourth planes lined up from right to left.



The Datco automatic checkout system can't be completed until you tell us how.

Datco is an off-the-shelf checkout system. Datco is a tailor-made checkout system. Can both these statements be true?

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This means that if there are changes in the weapon system to be checked, you keep the same Datco. If you want to check out a different weapon system, you

keep the same Datco. Sometimes new modules may be needed, often the only change necessary is the roll of punched Mylar tape that feeds Datco instructions. Datco is not only versatile; it is also completely dependable. It's so dependable it even checks itself. No internal fault can go undetected. Furthermore, the punched tape can be "proofread" at any time to be sure the test procedure is correct.

If Datco doesn't become obsolete, and doesn't make mistakes, just what does it do? It checks out any weapon system perfectly. That's all.

NORTHROP NORTRONICS

son set at 85 ft/sec. The third radar set controlled the chase plane through the cockpit. The airplane climbed at 275 ft/sec and then climbed to 245 ft/sec. At 2000 ft/sec. After a series of steep turns to demonstrate the improved internal loads, the D61-125 was put into a climb stall, approaching it at a bank steep attitude to lift off the engine speed. At 100 ft/sec, a slight buffet was felt, and the airplane stalled out at 90 ft/sec with the nose dropping off and with a slight loss of altitude experienced.

With the flap set at 90 deg and the landing gear down, the airplane stalled at 75 ft/sec with no evidence of wing drop, so the same configuration but in 20 deg turn to the left, and was stalled at 90 ft/sec. In the latter stall, the D61-125 turned to come out of the turn at stall, rather than to spin it so.

The airplane is also fitted with a stick shaker which will be a production modification and gives sharp warning at speeds above 120 ft/sec ahead of stall. At high altitudes, angle-of-attack procedures are artificially simulated with manipulation of the thrust sensor device. When one throttle is actuated, the device induces an asymmetrical flow from the first reduction of thrust reduction. The immediate reaction to the loss of the engine is a drop in speed, rather than usual wing motion.

Presently, the device, of course, is an engine loss not taking. It allows the pilot to control his plane without recovery, and, under conditions.

D61-125 U. S. Price

Domestic—First price for the D61-125 D61-125 production price is \$175,000 for a base lot which includes pilot seats and basic engine mounts, according to Haskel Scientific, Ventura.

Price for the equipped airplane, fitted with nose radio, radio and navigation aids, will be \$750,000. Price with support data and flight test facilities, in addition with D61-125 Test Stand, is \$1,000,000. It is set up as an installation having no test plan used at reducing the cost by operating from one several sets. Under the standard plan, D61-125 Test Stand will cost at least the entire first set with equipment used over a 10-year schedule on a contract that will include test stand for a base lot, the aircraft may be acquired for 30 years on a rental basis.

D61-125 Test Stand, through a program with the Armed Club Group, will finance the airplane in 21 months. Locations: Holland, Belgium, Denmark, Portugal, France, Federal German Republic, Italy, India, Norway, Sweden and Switzerland.



D61-125 cockpit mockup shows standard layout for production aircraft. Note Y-shaped wheel and locations of radio and sensor equipment, with subpanel, an engine console.

The first landing was made in a configuration condition, with the right engine throttled back and the sensor device operating. No radar turn is needed, as far as flight control is concerned, the pilot's most important problem is recording himself that one engine is not delivering thrust, maintaining pattern speeds higher than normal to compensate for the loss.

In that case, the downward leg was flown at about 175 ft/sec with gear down and 15 deg of flap. Speed was reduced to 140 ft/sec on the base leg, and land was flown at 115 ft/sec, instead of the usual 110 ft/sec. The landing was quite normal, except for the use of some altitude to compensate for a gust command that had developed near takeoff.

On a conventional landing, the airplane would descend a flat approach, due to its straight wing, but 110 ft/sec gives ample airflow for solid control. The pilot finds it necessary, to start flow out until reaching the runway, and the D61-125 attitude is in the main good.

The nose wheel is held off as long as possible, but the ground run is short and strong when rubber forces drive turn, is no problem.

An advantage to the pilot, in addition to excellent cockpit visibility, is the D61-125 "V" cockpit, developed to give ample low and high room during the most sharp maneuvers. The stick also presents a minimum interference in

checking various panel instruments. The aircraft is designed around a cylindrical fuselage. The decision to keep the cruising speed to about 180 mph eliminated the necessity for extreme wing sweep and airfoil thickness, and also avoided the complexity involved in simulating power controls (AW Dec 8, p 130).

The passenger cabin features a recessed seat, made possible by raising the wing under the fuselage, which is low angle fuselage. The airplane has been fitted out in executive style, with no seats, but the D61-125 is not scheduled with the interior floor and probably will modify this considerably before delivering the aircraft in quantity. Air conditioning outlets also will be supplied.

Cockpit instrumentation varies widely in each of the four lightest airplanes, depending on the program mission, but has been fitted out in the production cockpit at Hatfield. Cockpit radio and visual aids, ordered in quantity for all D61-125s, eventually will include a solid-state radio not yet delivered to Hatfield.

Another cockpit change will be the grouping of warning lights on the control panel, maintaining the present "atten line getting" lights on the upper panel which usually left the pilot that some system is failing, notwithstanding his testing the fault.

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Fuel injection systems, replacing the carburetor of earlier models, and a new auxiliary injector cooling system are the major changes made in the latest Branch B23 two place helicopter. Cooling injector allows longer sustained hovering in hot weather and has increased the service life of the engine to a maximum of 750 hr.

Aerovox Corp. of Middleboro, N. J., has reported a 41.0% increase in net income and a 265% gain in sales for the first nine months of fiscal 1963, ended April 30, compared with the same period in fiscal 1962. Earnings in the 1963 period was \$576,979 on sales of \$14,570,753, compared with earnings of \$300,172 on sales of \$12,128,386 during the comparable period in fiscal 1962.

USAF has purchased 25 Model 285 Silverstar rifles from Cassia and contracted with the manufacturer for training of flight and ground personnel. The aircraft will then be sent overseas to several foreign countries under the Military Assistance Program. Hawthorne Aviation Corporation, S. C., will provide flight training.

Federal Aviation Agency is studying the possibility of tightening regulations governing spot purchasing and allowing buying of light and ground personnel and facilities. FAA personnel met with members of the Private Club of America in Washington recently to discuss possible steps. FAA personnel is advising some of the club employees in purchasing, design, fabrication and packing.

Pieces of most aeronautical charts prepared and sold by the U. S. Coast and Geodetic Survey have been increased. Prices for Instrument Approach Procedure charts have been increased from \$32 for waterway coverage to \$37 for each section in the series. Sectional and local aeronautical charts were increased from 25 to 30 cents each and Aeronautical Chart 1094 covering the North Pacific has been increased from 10 to 15 cents. The price of radio facility charts has been increased 40 to 60% when delivered by mail on a subscription basis.

Piper is extending the warranty on all new aircraft sold by it to six months or 150 hr. flying time. The warranty period previously was 90 days or 50 hr. New warranty period is effective immediately. Warranty does not include accessories which normally are furnished separately by their respective manufacturers.



LONGER WINGSPAN of the new Piper Cherokee 235 is shown with addition to wingtip beginning at black lines, which indicate 12-gal. wingtip fuel tanks. Standard 15-gal. tanks are outlined on inboard leading edge of wing.

New Cherokee Features Payload Increase

Gross weight increase of 750 lb. and useful load of 1,490 lb., among the major features of Piper Aircraft Corp.'s new 235-hp Cherokee, has plus payload.

Newest Cherokee variation, now in production at the company's Vero Beach Fla. factory (ENR Apr. 28 p. 55; Aug. 12 p. 77), is powered by a 235-hp Lycoming O-540-B2B5 engine which gives it a top speed of maximum gross weight of 160 mph, and a cruise speed of 116 mph.

The Cherokee 235 has a wing span

of 32 ft., two feet longer than previous models. Increase has been made possible by the addition of glass fiber wing tips which double, as tip tanks each containing 17 gal. of fuel.

This increases the fuel capacity of the Cherokee 235 from the 76 gal. of earlier models to 94 gal., giving an operational cruising range of 1,130 mi. at 55% power at 10,000 ft.

Basic price of the aircraft will be \$15,500.

In addition to the other changes, a new cockpit design has been adapted to

fit the new engine. Control seats, in two pieces of glass fiber and steel, completely reworked to expose the engine.

Landing light is located in the nose and the run-in scoop for the carburetor is offset to accommodate the new fuel system.

Engine drives a fixed-pitch McCauley propeller.

Gross weight of the Cherokee 235 is 2,900 lb., up from the 2,150 lb. gross weight of the original Cherokee 150. Useful load of 1,490 lb. is about 50



PIPER CHEROKEE 235, latest addition to the company's fleet, has a distinctive contoured glass fiber and steel cockpit, the 235-hp Lycoming O-540-B2B5 engine. Gross weight has been increased to 2,900 lb. and useful load is 1,490 lb.



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It weighs less than the empty weight of the Cherokee 215.

Piper says the useful load is as great as Cherokee 215, that the Autolite model-variant is thoroughly equipped of the several systems offered—can carry 170 lb. passengers, full fuel, oil and 200 lb. of baggage and still not be up to maximum gross. Accordingly, the company also quotes performance figures at what it believes is a more normal operating weight of 2,400 lb.

The engine will burn 80 octane fuel and a four-way selector valve on a console inside in the fuselage allows one of the fuel tanks to be used individually. Swap valve is cockpit-controlled.

Besides the cowl and the wingtips, glass fiber has been used in the tail surface edges.

Structural members of the aircraft have been strengthened, Piper says, to accommodate the higher speeds and weight of the Cherokee 215.

Landing gear remains unchanged from the Cherokee 180. It has a 10-ft main wheel base and uses three 5.83 x 6 wheels. Brakes are hydraulic.

Introduction of the Cherokee 215 will not affect the production of the other three models in the line—the Cherokees 150, 250 and 350, Piper says.

Cessna, Piper, Beech Report Sales Boosts

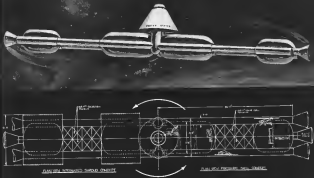
Cessna, Piper and Beech all reported increased sales for the first nine months of fiscal 1965, ended June 30, compared with a similar period in fiscal 1962. Cessna and Piper also reported greater net earnings.

Beech's earnings rose down, due to start-up costs on several new programs, including the Blended 16 King Air C-440. Age 19, p. 291 and military programs.

Total sales reported by Beech was \$52,884,145, an increase of approx. 7% over last year's \$49,451,721. Net earnings were \$1,579,000, equal to 96 cents per share, compared with \$2,155,214, or 76 cents per share, in the first nine months of fiscal 1962.

Cessna had total sales of \$74,920,000 during the first nine months of fiscal 1963, compared with sales of \$72,855,000 during the same period last year. Net earnings for the period were \$4,028,000, or \$1.33 per share, compared with \$4,465,000, or \$1.35 per share, for the fiscal 1962 period.

Piper reported sales of \$36,878,737 for the nine-month period, compared with sales of \$26,485,351 for a similar period last year. Net income for the period was \$1,732,636, or \$1.61 per share, an increase of 24.4% from the \$1,391,041, or \$1.30 per share, reported during the first nine months of fiscal 1962.



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Industry Mixed on DOD's Profit System

By William H. Gregory

New York—Reaction to Defense Dept.'s weighted guideline profit system, which incorporates incentives and profit performance evaluation, is patchy, although industry at the base of the basic policy statement and profit stipulations as to its translation into action.

Nab of the armed services is typical in two contradictory responses.

• Profit objective of 10-15% is laudable, says Armed Services Procurement Regulation 1405 causing the industry. Consider the example price in which a purely hypothetical firm, Foodco, is in contact with, i.e., fact that the application deals in such economic terms could instead be an aid to the use of overvalued declining defense sales in profits, says industry critics.

• Little hope exists that armed policies will push to even approach the first critical measures possible.

As one industry contracting executive explained, his company might be called to ask a maximum 15-16% profit (there, too) but a security and development contract was in the past stage, but the company would not even begin by asking more than 12-15% for his of coming from among the government agencies.

Industry itself is divided in opinion on the degree of rational goals to expect. The optimistic, though doubting that the maximum will ever be attained, feel there will be significant improvement. The pessimists for DOD, despite the good intentions, profit levels will not, left or not at all, in any measures will be lost in a race-by-Rs negotiation. Based action, for example, administration of the policy in the current impudent and realistic contract will be expensive to provide the industry. Critics in this respect view from industry feeling that existing ARPA that requires policies desirable to industry, sometimes lose their benefits in practice.

To increase the administration element, industry has turned to existing contracts needed under DOD's new

policy, viewing as of them to replace and give final to the contract. Favorable results with them would back up for the weighted guideline system.

For major PERT activities have been studied in these programs so that an indication of profit needs are well down the road.

Early reactions, though, are that DOD's contractor administration goals are being selected. As an industry source commented: "Maximize a program that's on an incentive, control and exercise in the short stand up to what?"

PERT activities would PERT facilities in some places because of their appearance in order to PERT not underhand, have lost in coverage programs, but these are more reactions that probably would have been met about details in an event, and are, in any case, means.

Generally connected by those with scientific experience in that, at least initially, the system has broken out of the system. Such a under war, for example, for major projects on staffs that go to fulfill level-of-effect types of contracts.

Secretary of Defense Robert S. McNamara's efforts in these new programs to set a profit, a relatively minor 15% when increased against the 15-16% in government only, to offset the cost, at the top also is being watched with some feeling by industry. So is his campaign to protect a controlled picture to Congress, and the public, of successful cost efficiency in the Defense establishment. Success of the new policies and difficulties of the task has left industry both sympathetic and skeptical.

Language of the policy statement that looks off the new regulation profoundly surprised industry, not much for its support of the profit system but even more, for what is regarded as its industry evaluation of just one indication of risk in operating toward. This included such phrases as:

"Profit generally is the basic motive of business enterprise. The government and defense contractors should be concerned with increasing the motive to work for more effective and economical contract performance."

"No, obligation of very low profit, the use of internal incentives, or the automatic application of a percentage not perceptible to the total situation and of a profit, does not provide the motivation to accomplish such performance."

"Furthermore, low average profit



Two-Place Beech BD-1 Makes First Flight

Beech BD-1, low-cost, two-place aircraft being developed by Beech Aircraft Corp. of Springfield, Ohio, is shown during its first flight. The BD-1 is designed to sell at less than \$2,495 with a retract 65 hp engine, automatic accessories and no cabin. Some completely equipped versions will sell for about \$4,200. Company hopes for certification by spring. The BD-1 has a shrouded fuselage of metal, aluminum and plastic. Wings are detachable for use of ground transportation.

into the defense contracts recall are detrimental to the public interest. If the current national defense in a free enterprise, comments, argues that the best of limited capabilities, is attracted to difficulties, outsiders. These capabilities will be shown away from the defense market of defense contractors are characterized by low profit opportunities.

Consequently, negotiations proceed much at industry costs by adding profits with no subsidies of the function of profits, cannot be overlooked.

"For each contract in which profit is negotiated at a separate element of the contract price, the act of negotiation should be to explain the profit value to us to supply effective contract performance, in which result contract such an automatically controlled."

In response, contractors worry that this language seems to take them account the consequences of supplying profits, as "being into" contracts a product that will result in a cost overrun later. As one industry source said:

"Setting down price in negotiation with a contractor who has a plan to keep him and is asked to meet will often result in his taking advantage of a good businessman's desire to take. This would mean going back later, but in kind, to ask for more money to cover the overrun."

Caution in the cost program falls generally into two categories:

• **Minimize cost functioning of the equally new DOD contractor performance rating system.** Ratings perform

the system are one element that must be incorporated as a rational value in comparing weighted guidelines, profit stipulations.

• **Defining in the response of the contracting officer, who retains his full direct responsibility for negotiating profit under the new regulation.**

Apprehensions about the performance rating system a strong, but not always specific. As one industry source explained, there is debate for the prospect of having to become a subject in company performance reduced to a grade on a report and spread out at a company.

Another contractor feared performance evaluation will cause more paper work and more participation, two requirements already the cause of much industry grumbling. Still another noted the point of the weakness of performance rating as part of the weighted guideline system. If a contractor had to be rated at the bottom of the scale, on the basis of his past record, who would the government then consider him for another program to begin with?

Subcontractor performance was a problem in another potential danger area in the contract. In an early system development, subcontractor performance can make or break the prime contractor record.

Contractor attitudes are leading more and more toward holding the prime contractor fully responsible for subcontractor failure, a tendency, given a hard push by the McNamara administration, will be the "pushing" of

profits (AW, Apr. 23, 1967), p. 241.

"We don't have the same control over subcontractors that the government has over the prime," one industry contracting official observed. "We aren't their sole contractor, in the government it is our case."

But more shadows doubt also concerned this same official. The system was used of the contractor being blacklisted in Kefauver-Harkin, without acknowledging why.

Overvaluation and paperwork are two points also raised in dealing with the risk of the contracting officer. Opinions here varied, both pro and con.

Some see the explicit guideline as a language of examination, cost pricing and benchmarking of the negotiation process. Others see the guidelines as one of the most favorable features of the system. Instead of the vague and cloudy environment that is now, often the only three reasons lack the contracting officer will have specific precedents at hand.

That the contracting officer keeps his profit negotiating responsibility is self was termed a plus factor in at least one instance. Such negotiation can best be handled by the man close to the issue, not by higher authority, or a board of review, in this opinion.

More often, industry questioned whether the contracting officer to present himself will be forced to have to the limits end of the scale. Considerable present judgment may be required in evaluating the many factors that combine to produce the final profit al-



Saturn Meteoroid Satellite Deployment Shown

Meteoroid detection satellite, having a total span of about 160 ft., will unfold from the Saturn payload bay after launch scheduled for next year. Camera view (1) shows stored panels. Close-up (2) and (3) and panels are extended in folding arm (4). Presence of panels in space will be detected in early stages on the panels (5). Satellite will be launched by Saturn V's 1st and 2nd stages. Fairchild Space is developing the satellite for National Aeronautics and Space Administration.

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A. B. Sengupta et al.

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loading sets. It is assumed to be the fluid production use of a continuous program in which the prime contractor has overall system compatibility and acceptance responsibility, but in which the prime except for guidance system and launch equipment, will be subcontracted to a single subcontractor. Both prime and major subcontract can low cost and deliver insurance. The estimate follows.

Estimated Costs (\$000)	Assigned Weight (%)	Profit (\$000)
Contractor's Input	Best Materials	
Purchased Parts	\$4,800 3%	\$ 130
Other Materials	5,000 3.3%	80
Subcontracted Items	\$9,000 3.93%	90
Engineering Labor	380 15.56%	34
Engineering Overhead	200 8.85%	17
Manufacturing Labor	1,000 5.6%	56
Manufacturing Overhead	1,300 5.62%	86
General and Administrative	6,000 4.94%	417
Total Composite Weight		\$5,710
Risk	2.5%	
Performance	3.06%	
Selected Factors	—5%	
Profit Objective	6.67%	\$4,264

In assigning weights for the contractor's input, the contractor of four broke down the subcontract costs into those of prime complexity, which rounded the top 15% weight, those for components manufactured to prime contractor design, given a 4% weight, and the major subcontract for the main and support equipment requiring little supervision, which got the bottom 1% rating.

Composite Weight

Since the latter was 70% of the negotiated cost in the prime of direct materials category, the composite weight worked out near the bottom of the scale at 1.03%. Since contractors govern other contractor input weights.

Engineering labor, with a substantial portion of senior engineers, accorded a middle ground weight of 11.9%. Manufacturing labor, most of it unskilled, was not above the minimum percentage at 5%.

Because of the high ceiling, 125% proposed by the contractor and because the incentive award in profits would be passed along to the major subcontractor, the percentage weight for risk was also the minimum end of the scale 2.5%.

Previous performance of the contractor

in developing systems and fielding a complex missile system in a short time was assumed as outstanding, and so was a high degree of cooperation in small business design, which surplus program. Operating in R&D laboratory that had produced significant state-of-the-art advances for the defense effort also was considered. This accounted for a maximum rating of 2% in this category.

Because both prime and subcontractor margins previously were applied to, and because 50% of the total finished item government financed, a -0.5 weight was allocated here.

Final Objective

The sum of the four major category profit figures — 6.67% — multiplied against total costs, produced the final profit objective of \$4,264,000.

Some change in expected in profit negotiations, but no significant departure of the final negotiated profit from the contractor's official proposal. The profit objective must be demonstrated in detail for inclusion in the contract file and use by awarding authority.

Because of incentive provisions, dual-costing contract changes, i.e., the actual profit earned will probably vary from that anticipated at the time of negotiations.

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PROBLEMATICAL RECREATIONS 186



The consequences simultaneously shoot at and hit a rapidly spinning spherical target. What is the probability that the three points of impact are on the same hemisphere?

—Cousins

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CLEAN FEATURES OF THE C-141 are evident in external view. Ground clearance at maximum gross weight is 39 in.

Air Force Minimized Engineering Changes

By James R. Ashlock

Atlanta-Lockheed C-141 StarLifter jet transport has been subjected to rapid Air Force instruction on engineering change proposals during its 75 years of development, resulting in an aircraft built basically within the existing state-of-the-art to satisfy requirements for both military and commercial applications.

Approximately 50 design changes were proposed on the airplane, but less than half of these were approved by the Air Force Systems Program Office (SPO), for C-141 development at Wright-Patterson AFB, Ohio.

Reduction of change orders has become a prime goal to USAF presence, and the C-141 is one of the first major programs to feel its effects. In the past, aircraft transports have been subjected to as many as 100-200 engineering design changes in the period before delivery.

Accepted Design

"One of the first objectives we set up for the C-141 was to hold the aircraft as close as possible to the accepted design, a Systems Program Office spokesman said.

If these changes appeared for the C-141, some affected the basic design. This is evident in accompanying design competition drawings with the first aircraft, which was inflated out late in 1963 (AVW Aug. 26, p. 3).

Design changes were further restricted by the Federal Aviation Agency's participation in C-141 development. The

FAA's role is to blend as much commercial ability as possible into the aircraft and the agency's approval was required before the military could initiate any design features.

"We were limited that while we could change military specifications to meet our needs, we could not change FAA regulations," Col. M. B. Hunt, head designer of the C-141 SPO said.

Despite the competition inherent in any joint military/civil contract, Hunt noted he was now favoring the FAA's participation.

Transport Development

"I am convinced that this is the way for the Air Force to go in the development of transports, he said. Through the FAA's contributions, I believe we've come up with a better airplane."

The C-141 rolled out first, before the accounts of commercial consideration. It is a relatively clean, uncomplicated airplane, free of such innovations as leading-edge slots, vertical fins or doors, which attract attention to aerodynamic drag.

Even designers no much are involved in the effort it would have on commercial efforts, Hunt noted. "Even if this aircraft had been built strictly on commercial consideration, I don't think the basic airplane could have made any changes."

Air Force does have approximately 7,000 to 8,000 lb of equipment aboard the C-141 that would not be required in commercial operations. But at all, including the heavy-duty floor, is provided so that it can be left out of the civil version, designated the L-140, without affecting the airplane's basic design.

Minor changes are made in the C-141 wing, which covers 1,225 sq ft in its 160-ft span. Lockheed says the wing took only 25 days, as opposed to 70 or 75 days on other U.S. jet transports now in both military and commercial use.

This enabled us to maintain good tolerances and landing performance without resorting to such things as leading edge slots," R. D. Gibson, C-141 project engineer, said.

Moderate sweepback also allows use of a single electric line for tip of each wing, rather than a dual electric system, which on-board controls are inactive during time to prevent a single wiring error. Rear wing area aboard of the airplane is devoted largely to quieting the cabin through the Fowler flap.

Wind Tunnel Tests

Original design of the C-141 proved out well in wind tunnel tests, but an alteration was necessary in the wing around the horizontal and vertical balance connection point. A hinge was used to allow the wing to be replaced by a large box-like shape cut which engineers call the "beehive" (see "A weight addition of 40 lb resulted from the change."

Original drawings show a uniform height to the hinge, but the final outboard fin is a half-inch thick, which should be a point. This resulted from changes in the air cargo door hinge arrangement and in the positioning of the



FOWLER FLAPS are the only high-life devices on the C-141 wing. Horizontal stabilizer trim also is 33 deg down and 4 deg up.

on StarLifter

ally wing, which loses the aft fuselage behind where attached.

Lockheed engineers on the StarLifter brought an added benefit in providing even longer structure to which they could attach the stabilizer, giving it more strength.

The C-141's most distinctive feature is its light deck, where the vertical presentation height and engine exhausts control with the main deck based on earlier models. Adoption of vertical presentation was one of the engineering design changes approved during C-141 development.

"We adopted the vertical exhausts not only because they are, technically, accurate, but also because they require less panel space," Hunt noted. For example, with this system, engine exhausts will provide the data through, presented on 28 second duty."

Air Force sought the most accurate measurements to assure precise positioning on each engine in advance. At that time, the C-141's flight instruments are electrically powered and linked with a computer system.

The old pressure altimeter sample and good enough for the civil use in terms with the C-141, Hunt noted.

The altimeter control set data computer system regulates and controls the flight instruments, but also the artificial fuel system back into the controls and the C-141's air conditioning system. The computer system receives inputs from the pressure and temperature sensors of the engine exhaust, which also provides them a altimeter, trim, and ex-

hausted, and Mach number. The computer also sends airspeed, altitude, and engine vibration warning light when malfunctions exist.

The C-141's main deck must couple equipment that would not be needed in commercial use, particularly in domestic routes. The area below the light deck is packed with navigation and communication gear, and fully partitioned sections are on the light deck for the navigation and flight instruments. In addition, there are boxes and wires for a second floor main deck and a galley.

The fueling is installed with 28 in

frames, the most intricate of which is the high-pressure pump, extending for 10 ft and from this critical stabilizer.

Lockheed engineers originally planned to install the C-141's air conditioning system in the landing gear pods, but decided later to place it in the wing center section, which otherwise would have been vacant. The dual air system works off an air intake powered by engine bleed air. Each of the dual main pods has 110 lb/min cooling capacity.

Left in the main pod was the aircraft's auxiliary power unit, which starts the main fan ground and in start



THRUST REVERSER ASSEMBLY provides 41% of engine power for landing. Thrust reverser is through center core, while forward fan or gases through the outer ring.

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Model 909-1000 is a development of Consistent Data Systems Corporation and available exclusively from Bendix-Pacific. Contact Bendix-Pacific, North Hollywood, for complete information.

Bendix-Pacific Division



HEAVY CENTER-SECTION FIBERWIRE of the C-141 is evident in standard elevation view. Vertical extension on wing attack mount. Loading gear attach point is shown in sideview. Large area forward of cockpit houses a 30-in. radar antenna dish.

ing engines. The C-141 is fueled at 500 gal/axis, though easily available in kits located in the rear of the right gear pod. Crossfeed pumps are in the wing box. Each wing has five fuel cells.

An F4U mounted on every effort to make the C-141 as independent as possible from ground support equipment. The vertical stabilizer carries a ladder inside it for accessibility by maintenance personnel. The aft loading ramp sets up a ramp to the ground, the average height of truck-loader beds, to clear into the and the back lifts and other cargo loads. The wing also houses its ground level for direct access by troops or vehicles.

Initial specifications included a side cargo door in the left forward area of the fuselage. However, Air Force experience with the Lockheed C-130 Hercules shows infrequent use of this door. It has been left as the C-141 and also was discarded on C-141s now carrying all the production lots.

Structural work made an placement of the C-141 landing gear on the wing to provide more ground support for the wing's heavy engine and fuel load. But an extremely long gear strut would have been required because of the high wing, and placing the gear on the fuselage resulted in the gear assembly being 25-30-in. lighter because of the shorter struts.

Wing construction represented the largest subcontract among the 1,534 companies in the U.S. and Canada which supplied components for the C-141. Aero Corp's Aerospace Structures Div., Norwalk, Conn., built the wing boxes and showed them to sail to Lockheed's facility here. Aero's contract alone in the C-141 program has topped \$65 million for tooling and wing box assembly.

The aircraft's entire 23,000-gal fuel

capacity is within the wings, another plus factor toward FAA certification of the C-141 for commercial application.

The wings are not joined directly through the wing box, but are joined individually to the largest fuselage rings. Four main line extensions from the wings converge the wing portions, providing a rigid connection. Wing loading is 97 psf.

Negative dihedral of 1.2 deg is designed to counter wing warpage on the Roll loadings, giving the wing tips 42 in. below the root. The wing tips rise 10 in. in height, but this feature is absorbed in the outer wing and brings little stress to bear on the fuselage attachment point.

Attaching of the wing loading edge

is achieved with hot air circulation. The wing is heated 1 deg root to tip to offset wing twisting.

Perforating the horizontal stabilizer along the vertical for squared special air intakes to weight, and 100 lb was saved by using glass fiber rather than metal for the leading edge. General Dynamics/Cessna built this unit, including the anti-wing swing rolls in the flap.

The horizontal stabilizer, with a 50-ft span, is larger than the wing on Lockheed's jetliner executive aircraft.

Lockheed was able to incorporate some features of the C-130 into the C-141, including the a.c. electrical system, boost power control for the alternator, the nose landing gear and engine



VERTICAL TAPE PRESENTATION on tape reader mounts gives data on exhaust pressure ratio, fuel flow, and high and low-pressure ratios, exhaust gas temperature and fuel flow.



1933 target: vehicles on a highway



1963 target: vehicles in space

Thirty years ago, Westinghouse engineers in east Pittsburgh learned radar waves from the plant roof and detected moving automobiles. They didn't call it radar—"the world didn't hear it yet." Radar development at Westinghouse has involved every path since 1933. Defense Center scientists have consistently pioneered in advancing the art—from the rooftop experiments to detecting enemy

planes approaching Pearl Harbor to tracking vehicles in space. Systems in action today include radar for airborne and space missions, search and weapon control, tactical and fleet air defenses, shipborne and ground based acquisition and tracking. Typical of current projects of the Westinghouse Defense Center are the AN/SPG-59 ship board fire control radar for the Navy's TYPHOON program and the land-based

AN/SPG-57, a long range air defense radar in the Air Force's SAGE system. Continuing Westinghouse leadership in radar research and development engine-ers a unique capability for the future. It is a capability to be matched with in any serious discussion of advanced radar systems. Write to Westinghouse Electric Corporation, P.O. Box 688, Pittsburgh 30, Pennsylvania. You can be sure... if it's Westinghouse.

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PRODUCTION BRIEFING

Air Reduction Sales Co., New York City, will build an \$800,000, 1,000-hp peroxide gas turbine and liquid oxygen, nitrogen and argon plant in New Orleans, adjacent to National Aeronautics and Space Administration's Michoud facility. The plant, to be located on the intracoastal waterway, will transport liquefied gases in specially modified barges, both along the waterway and up the Mississippi River.

Local Electronics Corp., New York City, has concluded an extensive cross licensing agreement with Contronic AG, Zurich, Switzerland. Local has exclusive U.S. rights to the Swiss firm's aerial fire control systems, remote telemetry systems, and portable computers. Contronic has rights to certain Local navigation, display, aerospace and electronic warfare equipment, in its European countries.

Martin Co.'s Denver Div., has a contract from NASA's Launch Operations Center for a four-month study of ascent and escape problems associated with large space launching structures, with emphasis on the Saturn launch system.

Rocket Research Corp., Seattle, Wash., has a \$49,770 research contract from Air Force Rocket Propulsion Laboratory, Edwards AFB, Calif., to study hypersonic ignition of gaseous propellants.

Gosselin Mfg. Ltd., Ontario, Canada, has a development and production contract from RCA for 15 self contained cooling systems for electronic packages aboard the electronic communications (ECM) version of the CF-108 aircraft. Current test lot to be shipped at a rate of 19,000 B.T.U./hr.

General Dynamics/Forsyth has received a \$1.1-million follow-on contract for R&D work on Army's Master weapons system.

Systems Engineering Laboratories, Inc., Ft. Lauderdale, Fla., has been awarded a \$100,000 contract from NASA's Lewis Research Center, Cleveland, Ohio, for design, construction, and evaluation of a digital data system at NASA's Plum Brook Station, near Sandusky, Ohio. The system will be used to obtain data from over 400 points at a rate of 10,000 measures with per second, generally, in connection with the Centaur program.

Tell Associates Co., Buffalo, N.Y., has a follow-on contract for over \$1 mil from NASA's Lewis Research Cen-

ter for production of nuclear control systems for the Centaur upper stage vehicle.

American Petroleum Institute will make a March 3 supersonic transport will burn fuel at about 34,000 gal./hr. Today's jets burn 5 billion gal. in March, the Institute says, and by 1970 the consumption is expected to reach 4.5 billion gal. \$8.75 should create a demand for another 2.9 billion gallons annually, exclusive of subsonic jets and military aircraft by 1975.

H. C. Smith Construction Co., Los Angeles, will install communication system and the marine suspension equipment in the underground launching site in the seventh of American's SCBMs, under a \$17.4-million contract from Boeing Co. The work will be at sites near Western AFB, Mo.

General Dynamics/Forsyth has received a \$173,000 Army contract for study of a penultimate elevated radar system for battlefield surveillance. Forsyth also has received a \$70,000 Air Force contract for evaluation and recommendation of techniques and equipment relating to design of an air launched rocketborne to sense temperature, humidity, pressure and density at high altitudes.

French government has bought a Fordham Station Electronic Systems Div. APT (Automatic Positioning Transmission) ground station for use with the Tere 3 weather satellite this fall. The station will be installed at Lannion, Brittany.

Boeswell will transfer its manufacturing operations at Fall River, Mass., to its Industrial Products Group in Philadelphia. The Fall River facility manufactures industrial instruments.

Sylvania Electric Products, Inc., West Nyack, N.Y., will spend and more from two underground communications networks totaling \$30 mil. for Air Force's Titan ICBM program under a \$40,000 contract. Work will be performed at Schilling AFB, Kansas, and Wagon AFB, Cheyenne, Wyo.

Astrotech Research Corp., Alhambra, Va., has a \$2.5-million Air Force contract for an exploratory developmental program to demonstrate advanced technology in a very high performance solid rocket motor. Contract includes design, fabrication, and static test of experimental motor and delivery of two flight weight motors to Air Force. Prototypes will be delivered within 20 months.

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WIRE GRID HIGH FREQUENCY Launching lens antenna being built by TRG West at Mokai Island, Hawaii, for the Federal Aviation Agency is expected to lead to improved HF air-to-ground communications and large savings in land area required by ground antenna system. Ring frame, which supports double wire grids of the lens, is attached on the ground before being hoisted into vertical position.

FAA, Military Evaluate HF Grid Antenna

By Barry Miller

Mokai Park, Calif.—An unusual antenna concept which is expected to make possible high-performance, high frequency (HF) communications from a single ground antenna simultaneously to widely divergent aircraft or ground stations soon may be evaluated jointly by the Federal Aviation Agency and the three armed services.

The new antenna, known as a wire grid lens antenna, occupies no more land area than is now required by a single large HF rhombic antenna transmitting and receiving in one direction only.

A giant antenna embodying the antenna concept, which is a high-frequency derivation of the Launching lens principle, is nearing completion on the island of Mokai in the Hawaiian Islands. It was designed and constructed for the FAA by TRG West, a division of TRG, Inc., located here.

When it is completed and put into operation, the antenna is expected to provide far greater HF communication capacity with aircraft or ground stations on the routes from Mokai to San Francisco, Anchorage, Tokyo, Wake Island, Saigon, Nauru and Guam. Hawaii and Samoa. At present, over-the-water air-to-ground communications from commercial airlines are accomplished by HF, at least partially exploiting FAA's approximately \$400,000 support for the wire grid lens antenna development at Mokai.

The wire grid antenna constitutes an application in the HF range of an optical technique invented almost 50 years ago by the late Dr. K. K. Lauferberg.

Brown University optical professor. He proposed a lens made of a material the index of refraction of which varies parabolically from $\sqrt{2}$ at its center to unity at its periphery. This lens, the so-called Launching lens, has the unusual property that it can focus parallel rays incident

upon it from one direction to a point on its far side directly opposite the point of incidence. A spherical Launching lens is a focus for rays from any direction, a disk-shaped lens for rays coming from all directions in the plane of the disk.



WEIGHTS ARE ATTACHED to wires of the lens surface during erecting the ring frame to provide proper tension before the wires are attached to the upper ring frame. Area between ring and outer perimeter of poles is bridged by wires supporting lens upper surface.

In the years since Launching's work, his ideas were extrapolated down into the radio frequencies, particularly expressed as ultra high frequency (UHF). The Nike Zeus supersonic radar (AWA-17, 1961, p. 75) employs a spherical Launching lens.

Additional lenses placed at different points around the periphery of the area where beams will focus make it possible to transmit or receive in as many directions as there are feeds. Movement of the feed around the lens effectively turns the beam.

Thus, more beams can be generated in many directions from the same antenna at the same time. This is the basis for anticipating that the single HF antenna at Mokai, using a variation on this idea, will save ground compared to a large conventional rhombic antenna.

In earlier applications of the Launching lens concept to radio frequencies, the desired variations in refractive properties of the lens were achieved by the use of an expanded dielectric beam. The refractive index of the lens is varied by radial control of the diameter of the lowest dielectric or center chamber or elements embedded in the dielectric. The latter is the procedure employed in the Nike Zeus.

Lower Frequencies

For the larger antennas that would be necessary for operations at lower frequencies, such as HF, focused dielectrics in the required large sizes is impractical. To apply the technique to these lower frequencies, TRG West designed an antenna in which a pair of wire grids, one above the other, replace the focused dielectric. Variations in the spacing between the two grids account for the necessary parabolic variations in the effective index of refraction.

Working from this wire grid lens concept, TRG engineers last month were completing for FAA an 850-ft antenna installation on Mokai. It has a twofold interest in this antenna, according to G. Victor Rodgen, agency project manager, is to:

- Improve HF communications;
- Reduce the size of the area needed for HF antennas.

At present, a separate rhombic antenna is necessary for HF communications in each direction. One wire grid lens antenna, occupying a land area roughly equal to that needed by a rhombic, could have an almost limitless number of feeds. Even subsequent feeds on the lens antenna effectively replace one rhombic antenna.

A powerful limit to the number of feeds which could be used would be about 16, sufficient for complete earth coverage, according to Robert L. Tanner, TRG's vice president. The first wire grid lens antenna installations at Mokai will have only seven feeds to

link the seven coral locations, Tanner says.

Two such wire grid lens antennas, the second one to make directly reception possible, could make unnecessary much of the land area of the FAA's antenna here, Rodgen points out.

Although Rodgen says not specific about relative costs of a single wire grid lens antenna with multiple feeds, compared to an equivalent number of rhombics, he did indicate that should the forthcoming evaluation confirm anticipated antenna performance, he expects economies with this system. As a rough measure of what the economies, Tanner estimates the wire grid lens antenna with five feeds will be less costly than five rhombics, and this excludes real estate costs, which would favor the wire grid over one.

Even feed in the lens antenna provides a narrow, high-gain, low side-lobe beam pattern in the direction opposite from it. With multiple feeds, one lens behaves as many single antennas pointed in as many directions. The side-lobe levels will be lower, Tanner says, than those generated by a rhombic. Tests conducted by TRG West on a special scale model of the wire grid lens antenna support this. First side-lobe levels of patterns shown to Aviation Week & Space Technology were about 25 db down from the main beam; the average side-lobe level about 25 db below. The main beam, at the 16th ports, is about 5 db down. Typically, the side lobes of conventional rhombic antennas are only 6 db down from the main beam, which is on the order of 25 to 30 db. Performance of the Mokai or

seven probably will not match that of the TRG model, but it should be better than the rhombic's, according to Tanner.

The bandwidth of the lens antenna is broad (16:1), spanning the entire HF range (3 to 30 mc). A rhombic antenna, Tanner points out, performs over only a 2 or 2.4:1 bandwidth.

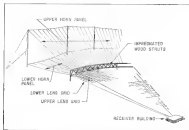
Joint Evaluation

In view of the antenna expected by the military services near the start of the program's year one, FAA is now attempting to arrange a joint evaluation of the Mokai antenna with the Army, Navy and Air Force. A second antenna version of this type, but only about half as large, and to be used for jamming testing, is being built by TRG for the Air Force at Rome Air Development Center.

Conceivably, one reason for military interest in the wire grid lens antenna would be its use for countering all HF communications, a possibility TRG deems to be remote.

As indicated in accompanying drawings (see below), the wire grid lens antenna, as constructed at Mokai, consists of a 605-ft-dia circular lens composed of two circular wire grids suspended one above the other. At the center of the lens the spacing between the grids is small (7 to 8 in.), with respect to the grid mesh size (5 ft), while at the edges the spacing grows large (12 ft) compared with the mesh size.

Contrasting with the lens is a tapering wire grid radial line lens which hosts the overall dimensions of the lens antenna to 816 ft. The perimeter



ENLARGED SECTION of wire grid Launching lens high frequency antenna provides insight in the layout of wire grids of lens and lens. With multiple feeds, the single antenna can generate beams in many directions simultaneously, unlike a conventional rhombic HF antenna, which is used for communications in one direction.



Despite the instantaneous speed and revenue appetite of today's most advanced computers, scientists at Lockheed Missiles & Space Company's Computer Research Laboratories feel that there is room for a great deal of improvement. They have dedicated themselves to the discovery and development of ways to increase the speed and reliability of computers while simplifying their operation.

Though today's computer circuits are capable of operating at speeds measured in tens of microseconds, the useful computation rate is far slower. One of the roadblocks hindering speed is the need for the computer to wait for the carryovers from one column of figures to catch up with the next calculation. A possible in-



novation to this problem is molecular arithmetic, which avoids carryovers. Based on the ancient Chinese Nine-ring Theory, this concept is being re-examined at Lockheed for potential computer applications.

Lockheed's Computer Research Laboratories are studying a very broad group of related computer research areas, and the company can boast that an unusual number of its specialists are at the very forefront of their specialties.

Among the major areas of research being undertaken at this time are basic physical phenomena, such as phenomena quantum mechanics; switching theory; residue arithmetic (number system research); threshold logic and pattern recognition and logic design techniques.

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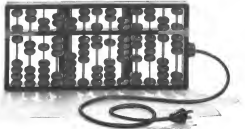
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Frequency mc	Width of Beam Aperture—(in)	Side-Arm Resolution (deg)	Approximate Elevation of Beam Maximum Above Horizon (deg)	Elevation/Angle(s) Where Vertical Resolution Decreases by 3 db (deg)	Approximate Gain Over Isotropic Antenna—db
3	600	38	10	~5-49	13
6	600	19	10	~8-38	17
10	600	11.2	10	~12-30	21
20	600-300	5.6-11.2	10	~15-25	24-21
25	600-240	4.5-11.2	10	~18-20	24-21
30	600-200	3.7-11.2	10	~20-25	26-21

GAIN AND BEAMWIDTHS are shown for a 600-ft. dia. normally polarized wave grid less antenna with a 90-ft. high boom.

of the boom increases the vertical span of the loss, thereby reducing its vertical beamwidth.

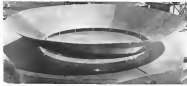
The grid wires are suspended from wooden supports, each like a wishbone, arranged in a circular ring at the periphery of the boom and within the boom. The grid wires of the boom are supported by a central extended aluminum ring forming the upper and lower chords of a circular compression truss which is tapered 18 ft. above ground to brackets bolted to the poles. Diagonal members of the truss are made of staggered wood.

Construction Procedures

In constructing the antenna, the poles were first installed, followed by the masts, as the ground of the ring boom. Wires were strung in the top and bottom chords of the truss and tied in the form of the grid network.

Diagonal spars were then placed between the two grids to maintain their separation in the event that the wires expand or contract with changes in temperature. At this point the boom was complete and was lifted into place using the ground tie, hoists at tacked to the mast ring (boom poles) and fastened to these points.

As is the regular Lambing loss, the sides of radiation for a wave propagating between the grids is 1-1 ft. at the center of the loss, which is the case.



SIMPLIFIED MODEL of a wire grid Lambing loss antenna used by TRG-West is especially determining from suitable scaling laws that at HF the wire grid loss antenna would generate high gain, low side-lobe beams. Side model measures 7 ft. in diameter.

The boom was made by suspending cables between the tops of the 25 poles in the outer ring of poles and then dropping 31 wires at 5 ft. intervals from each cable to the main structure. Other wires were stretched from cables over masts between the inner poles only 7 ft. above the ground to the lower ring of the boom. The wires forming the boom surface were stretched to proper tension over the boom by at leasting 90 lb. constant load to each, marking them and finally securing them to the top or bottom ring of the truss.

Twisting wires both will be situated on the periphery of the boom in beams can be generated in the desired directions. The present antenna was built as a receiving antenna, but it could serve equally as well as a transmitting one were this desired.

Tucker states that the techniques employed in building the Molten antenna are not necessarily those TRG would use for future installations in proving that the design plans simple, less expensive methods of constructing later wire grid loss antennas.

As is the regular Lambing loss, the sides of radiation for a wave propagating between the grids is 1-1 ft. at the center of the loss, which is the case.

spacing between the grids is small compared to each wire. At the edge of the loss, where the spacing between the grids of the boom is large, the operating index of refraction is unity.

Grid Characteristics

The pair of grid wires exhibits the characteristic of a gumbel-like varying index, changing from 1-1 to unity, as an optical Lambing loss. The reason for this, index is that the grids behave as metal sheets when the grids are in small compared to the wavelengths and the grid-wire spacing is large with respect to each wire. Under this condition, the region between parallel grids supports a quasi-transverse electrostatic mode (TEM) wave propagating with velocity approaching the speed of light. The pair of grids then has an equivalent index of refraction of unity.

When spacing between grids is small compared to each wire, as it is at the center of the loss, the grids behave as a network of interconnected open wire transmission lines providing an effective index of refraction of 1-41.

Operation of the non-grid loss antenna may be illustrated by reference to the plan view drawing (see p. 35) of the loss showing the poles and the far more complex pattern. Radiation generated by a single feed on the periphery of the loss will follow the indicated paths. It will emerge from the boom at the far side of the loss and be radiated into space. The wave would have a uniform phase front over a length equivalent to the diameter of the loss.

Moreover beam antennas could be placed along the boom extending from the feed through the center of the loss. Should the feed be outside the loss a similar type of performance would be possible by modifying the index of refraction.

Glass and borosilicate of a 600-ft. dia. normally polarized wave grid loss

**INTERNATIONAL
AIR TRANSPORT
ISSUE** October 7, 1963

To meet the information challenge created by the international character of aviation, AVIATION WEEK & SPACE TECHNOLOGY publishes each year an issue devoted to international air transport progress. This issue is received with such enthusiastic response that it will again be greatly expanded to provide the most comprehensive analysis and forecast of the air transport industry and its technical developments.

A vertical arrangement of stylized airplane silhouettes. At the top is a blue rocket-like shape with a long, pointed nose and a wide, triangular body. Below it is a black silhouette of a jet fighter with a high, curved nose and a single vertical stabilizer. Underneath that is a large blue silhouette of a four-engine jet with a high wing and a large tail. Below the blue jet is a black silhouette of a four-engine jet with a low wing and a large tail. Underneath the black jet is a small blue silhouette of a four-engine jet with a low wing and a large tail. At the bottom is a small grey silhouette of a four-engine jet with a low wing and a large tail.

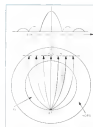
Issue three will be the current problems in international air transport including bilateral agreements, routes and tariffs, flight equipment, passenger, mail and cargo rights, air traffic control, the capacity issue, exchange of instrumental routes. Other subjects essential in a full analysis of the airline industry world will be discussed including trends in supersonic transport development, military transport operation, survey of Russian and Communist bloc airline activity, impact of U.S. international transport policy on world political and industrial relations.

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J. Mol. Liq., 2008, Vol. 139, No. 1, 1–10



PLAN VIEW DRAWING of wave guide line antenna indicates ray paths for a single beam in the lens perimeter. Radiation will be generated from the horn in the side directly opposite the feed. Additional beams around the perimeter can generate or receive separate beams in direction that is opposite the respective feeds.

radius) with a 90° high horn over the decade of HF frequencies are tabulated in the table on p. 83. The smallest or most beamwidths shown for the higher range of frequencies are for full illumination of the horizontal aperture; larger beamwidths are obtained when only a portion of the horizontal aperture is illuminated.

In the horizontal plane, half-power beamwidths when the lens is illuminated by a wave across its full diameter can be expressed in degrees as a constant (67°) divided by the product of frequency in megahertz and lens diameter in hundreds of feet. Typically, for the 600-ft. lens, the beamwidth is 11.2 deg at 60 mc.

The wire grid loss antenna can operate over the full HF band providing various beam patterns because the beam angles of reflection and consequent focusing properties are independent of frequency. This condition will be true as long as the mesh size does not exceed 0.15 wavelength. Hence, at the extreme end of the HF band (30 mc or 10 meters) the mesh size cannot exceed 1.5 meters, or 5 ft.

To check out its calculations, TRG built and tested a 5 ft dia. vertically-bellowsed scale model of the wave grid lens over the frequency band from 750 to 2,250 rps. The model lens was a single grid inserted over an aluminum cross plate, providing the same closed-circuit properties in the double grid lens at a lower deflection expense in small model form. Similarly, to keep cost

down, sheets were substituted for the east ends of an 8 ft. dia. radial beam.

The vertically polarized omnidirectional patterns of the antennas measured at different frequencies within the band indicated side lobes were down on an average of 25 dB from the main beam. First side lobes were about 20 dB down.

The concept of the HIF wire guiders, antenna array, back to work, done by Tansur at Stanford Research Institute, where he was manager of the electron magnetic laboratory. The idea was expanded and further refined by him and a colleague, Margot Anderson, now founding TRG West in late 1951. TRG West now has a permanent staff of about 50 doing R&D and construction of this and related projects.

AEC is First Customer For Control Data 6600

Chippewa Falls, Wis. — Control Data Corp. will deliver its first product line model of its new 6000 computer to the Atomic Energy Commission's Lawrence Radiation Laboratory, Livermore, Calif., in the course of 1984.

Cost of the machine, including a central processor, display console and keyboard, disc files, magnetic tapes, printer, control room and ten peripheral and control processes is over \$7 million, with monthly leasing costs of \$150,175,000.

The Model 6800 general purpose computer will be used at Lawrence, for the solution of three-dimensional hydrodynamic equations and simulation studies.

According to Control Data, the complex calculations associated with forecasting weather predictions and other scientific problems are the main areas in which the 6400 was designed to function.

Contexts at multi-programming of the 6680 is possible using 11 independent computers internal to the machine. It will take 20 minutes to switch over from one program to another, according to Control Data.

The readers across central readers scores 131-572 68-84 words at 12 levels of 8/200 words each.

The read/write major cycle time is 1 μ seconds. The average arbitration arbitration time is two major cycles with a minimum time of 0.5 μ seconds; possibly possible that there is no central arbitration bus conflict.

The disc flag system stores 504 red-flags bits.

Power consumption for the 6600 is 24 W, or 6 W for each of four logic module rows.

Most generated by the logic model is disrupted by a circulating from cooling system.




 The standard Peugeot
 MOTOR GEAR
 MOTOR DESIGN
 BMW AS SA, Turin

GENERATOR CORPORATION

has divisions Cable Modem

Engineers and Scientists



Join this Newest
Expansion in Our
DESIGN
for
PEACE

Join in time where there is a future for you and no one else. Here are projects which include Kodak:

- Nuclear Products . . . Nuclear Research . . . Atomic Research . . . Spacecraft Research . . .
- Cryogenic Research . . . Systems Research . . . Mathematical Research . . . Material Sciences Research . . .
- And scores more interesting two-stage projects, as well as the production of Giant Civilian Liners.
- C-130 turbo-prop transporters . . . Jetstar passenger craft . . . and "Hemlockbird" type VTOL aircraft.

President W. A. Pulver and Dr. J. F. Sutton, Director of Research at the Lockheed-Gorham Company, examine a scale model of the new 45-acre Research Center scheduled for occupancy by mid-year 1964.

Openings in the fields of: Aircraft Structures (Bent London, Strength Analysis, Fatigue Analysis) . . . Flutter and Vibration . . . Sound and Vibration . . . Aircraft Research Engineering . . . Flight Test Engineering . . . Aerodynamics . . . Operations Research.

Send complete resume, in confidence, to: Thomas J. Threlkett, Professional Employment Manager, Lockheed-Georgia Company, 834 West Peachtree Street, Atlanta 3, Georgia. Dept. 30073

Lockheed-Georgia Company

A Division of Lockheed Aircraft Corporation
An equal opportunity employer



Hybrid-Mikroskopie mit

High-density polyethylene membrane, a half-inch square containing 24 transmitters and metal tabs that connect with metal electrodes at least three mm long, is submerged in sodium water measuring only 40 ml of water—0.04 to 0.06 in. The device, fabricated by CEN Laboratories Div. of Columbia Broadcasting System, Inc., has electrically isolated transmitters with beta values as high as 180, a minimum current level of 1 microampere, a collector capacitance of 5 picofarads at zero bias and operates at power level of 1.5 microwatts per transmitter. The device is protected by a silicon dioxide lens.

FILTER CENTER

Multitrophic Systems Striving to Mimic Nature—Growing number of new *colletids* and *aculeate* wasps are being introduced to agricultural systems, as well as equipment planned for retrofitting into existing systems, are expected to use semiochemical matrices (in the form of their potential ability, much as in the case of conspecifics) to attract and/or repel their prey. New's Phosmet is an *in-gate* matrix that the garden entrance of the *Ag. Fauoi* (Dian 1) space heater and the *Agropy* Pushing machine. Previously, number of tests were reported (JAW Jan. 14, p. 15) on improved *Mutatis*, *Foliar* and *Agropy* chemical components and their use in small arboreal and other insect habitats.

• **Radiatac Sells Subsidiary**—Radiation, Inc., has sold its wholly owned subsidiary, Radiation at Stanford (formerly Leventhal Electronics), to Energy Systems, Inc., a new company, the joint-ownership of which are the former operating executives of Radiation at Stanford. Financing was arranged through Electronics Capital Corp.

■ **Scana Corp.-Aerquipilms**—Scana Corp. has purchased the assets of Electro-Optical Systems, Pasadena, Calif., research and development company. The assets

advancement of Electro-Optical will continue.

Manufactured Sales Growth Challenged. Factory sales of manufactured goods grew for the first quarter of 1983 through 64,473 units for a dollar volume of \$5,205,880, according to figures compiled by Electronics Industries Asia. This is the first quarter for which unit and dollar sales of manufactured were reported by EIA, although it did estimate factory sales for the entire 12-month period last year as \$7,312,190, suggesting that sales are sharply increasing. The association did not report unit sales for 1982, but with a policy shift to report where unit sales are available, it now covers over 90% of the total. All Signs indicate a value of government ownership, development and control and emphasis on trade that require delivery of an ex-

Letter to Encourage Multiple Microcomputer Sources—To avoid significant difficulties it might encounter elsewhere during its education program, Lotus Systems has initiated a program involving several potential sources of microcomputer components for the Phases or to-be-run-on computer and display systems. The sources include: Microsoft, Inc., of Redmond, Washington; Intel Corp., of Santa Clara, California; Western Automation, of San Francisco; General Electric, of Fairfield, Connecticut; and IBM Corp., of Armonk, New York. These companies were given development contracts to fabricate or microcomputer form a Lotus-designed logic element. In this manner, Lotus hopes to encourage the availability of multiple sources once the microcomputer system goes into full production.

Multi-Use Computers

New York—Radio Corp. of America has introduced here what it calls an "all-purpose" digital computer system, Model 5M1, which it said is flexible enough to handle a wide range of data processing, database management, control of high-speed data communications from periphery, depending on the functional modules selected.

Features include a nonmagnetic "trashpad" memory with 50 low-latency locations operating on a 250-nanosecond split cycle. Core sensors, accommodating up to 168,000 addresses, depending on units ordered, has a cycle time of 1.75 nanoseconds. A large-capacity data file can be added to provide storage for up to 18 million characters with an average access time of 100 nanoseconds.

For scientific use, addition of a high-speed arithmetic unit permits floating point addition in 10 microseconds, multiplication in 16 microseconds. In data concentration use, the system could either use wave grade channels equipped with digital relays to handle data at 2,400 bits per sec. or use



How high is your goal?

Once you and all others in the community of space. But your responsibility is a tangible reality, here and now at North American Space and Information Systems Division.

STRUCTURAL LOADS

The Rotomold Loads Analysis Group conducts studies leading to definition of the complete Rotomold load spectrum including pre-mold, lift-off, haul, landing drag in water, and recovery. Calculations will be made for the complete bearing-value-yield combinations including static effort, control torque operation, and atmospheric conditions to insure that all dynamic load conditions are accounted for.

ENVIRONMENT

The International Creative Group will determine which structural design criteria from International functional groups and NASA. The Creative Group will include ground conditions, atmospheric and space flight, access, re-entry, land and water landing, and recovery operations.

WITTENBERG

The Structural Methods Group teaches and conducts: STRUCTURAL Development Analysis, Analysis Methods, Digital Programs, Moment-red Shaking Analysis.

Interview/Phone Contact:
 MR. A. J. WHEELER
 ENGINEERING AND CONSULTING
 EMPLOYMENT
 12214 LANDWOOD BLVD.
 DOWNEY, CALIFORNIA

As a further guideline, all rental applications for apartment units owned by the University will be reviewed on the basis of the following criteria:

SPACE AND INFORMATION
SYSTEMS DIVISION

51. HELP WANTED—SEE

UTC

USAF TITAN III C — LONG RANGE PROJECT

We are prime contractor for the first stage of the USAF Titan III C, which includes two 120-inch diameter segmented solid propellant rocket motors. Together, these motors will develop more than 2 million pounds of thrust at lift-off—over 80% of Titan III C's total thrust. We offer challenging positions to qualified men for work on this space vehicle and for R & D and production in other solid, liquid, and hybrid rocket motor programs.

ELECTRONIC ENGINEERS—INSTRUMENTATION

The job: To develop control systems instrumentation. Requires knowledge of transducers, instrumentation, data acquisition and processing. Degree: BS in EE or Physics. Experience: A year or more.

SOLID TEST ENGINEERS

The job: To test solid motors . . . all that the word implies. You start to build, methods, equipment, procedures. A variety of assignments available, depending on degree and experience.

STRUCTURAL ANALYSIS ENGINEERS

The job: Stress analysis on big, big vessels. Required: Expertise in complex shell and semi-monocoque structures, knowledge of modal static and dynamic analysis. Degree: BS and 1-5 years experience.

VEHICLE SYSTEMS ENGINEERS

The job: Apply your knowledge and experience in using system ordnance shakedown, performance analysis, trajectory and load studies, vehicle and structure design, load/unload operation systems. Required: BS in ME, AE or Physics.

...THE ENVIRONMENTAL TEST ENGINEERS

The job: To build, test, and evaluate shatter chambers, testing TVC, and liquid ignition systems and perform environmental test 4-100-85 and compliance appropriate to assignment.

STRUCTURAL DYNAMICS

STRUCTURAL DYNAMICS
The job: To study space booster's response to high intensity vibrations, transportation dynamics, and other steady and dynamic loads. Work is theoretical and experimental. Required: Aerospace degree and 2-4 years experience.

SENIOR DESIGN ENGINEERS—AGE

Required: BSDE with about four years experience in ASDE test and related instrumentation and support systems.

Contact Mr. Jay Wolfe, Dept. 1

We acknowledge all inquiries and treat them confidentially. We strongly encourage qualified applicants. Women are equal opportunity employees. EEO, University Research



United Technology Center

1

5

P. O. Box 255 • Sunnyvale, California

Back Tommy to the
beatrix, back soon.
Meanwhile, look
what I found in
their 'naming's
paper!!!!



New Technique Separates Rocket Sled

Inertial guidance system testing methods have been improved by Air Force Systems Command by use of new techniques to separate a rocket sled from its rocket engine after a supersonic run on a high-speed test track. In tests conducted at AFSC's Air Force Missile Development Center, Holloman AFB, the pusher and towbody were separated by blowing apart their couplings with explosive agents. Aft-engine sled develops 165,000 lb. of thrust.

Six Aerospace Companies Report Officers' Compensations to SEC

Washington—Following is a list of aerospace industry divisions and offices with 1962 values above \$50,000, and their stockholdings, as they were reported in the SEC.

[illegible]

1946-1947 *Ernest W. Schuchard*
 Director—*Ernest W. Schuchard* 1947-1948
 1948-1949 *Ernest W. Schuchard* 1949-1950
 1950-1951 *Ernest W. Schuchard* 1951-1952
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 2108-2109 *Ernest W. Schuchard* 2109-2110
 2110-2111 *Ernest W. Schuchard* 2111-2112
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 2158-2159 *Ernest W. Schuchard* 2159-2160
 2160-2161 *Ernest W. Schuchard* 2161-2162
 2162-2163 *Ernest W. Schuchard* 2163-2164
 2164-2165 *Ernest W. Schuchard* 2165-2166

AVIATION WEEK & SPACE TECHNOLOGY, September 2, 1998

LETTERS

MMRBM Queries

As a single country, Inc. with 13 years of experience (mostly in Europe) with the USAF in Intelligence Targets, Weapon System Requirements, Vulnerability etc., and now with a major internationally competitive team I ask a few possibly stupid questions on the M5500M?

Dearing also noted that NATO needed a solid requirement for this capability (and I can assure you it is desperately needed) and that it was about a general desire to have a more "proactive" overall posture. He also noted that the NATO Secretary General had the Aug 5 issue to NATO. Early on, unannounced, he was known that it is feasible. Did the DDO or the diplomat or the politician call the flag back to NATO? Whether or not it was a "proactive" posture, it was a "stable" is that the usually most likely of "Alibi." McManus says "has decided to have an NATO-IR program, but that it must still be a pull-out class." It is quite possible that the NATO-IR program is ended in the Soviet bloc command. Of course, they are still within NATO. McManus notes and commented that the NATO

Robert C. Dornhaus
Los Angeles City

MA-9 Sightings (Cont.)

Once upon a time there were people who wanted to understand rights. These rights were called "values" and almost everyone believed them. Now there have appeared who wanted further rights. These rights were called "infirmities" and even scientists don't believe them. But by two clashing Astronomical Garden Cosplay's "infirmities" is, infirmities, is especially, is, values, the universe might will have modified the following:

1. The incident was being run very well and immediately rejecting reasonable observations by a competent observer.

1 Although not a highly trained observer of optical phenomena, astronomer Cooper must be regarded as capable of identifying familiar objects under most circumstances.

4. The criterion for visually evaluating two-point objects is usually regarded as one mosaic of an (1.5×10^{-4}) mm² area from 5 to 50 arc arc (AWR) from [7, p. 34]. Bono and Webb's 1979 review, *Principles of Display Design*, [8, p. 10] states that the visual resolution is one of an (10^{-4}) mm² based on the minimum limit in the Rayleigh criterion. The Rayleigh criterion specifies that two adjacent point or line objects will be resolved when the central maximum of one diffraction pattern coincides with the first minimum of the diffraction image of the other object. The Rayleigh criterion is mathematically interpreted, easily derived and measurably realizable. However, it is inaccurate in specifying the minimum limit of resolution for the unaided eye as it neglects the eye's temporal and spatial adaptation, such as persistence, adaptation, and contrast sensitivity.

to short light. Moreover the estimate can only be an incomplete specification because it does not take into account contrast, spectral distribution, and coherence of the light source (see, e.g.,

of the object's angular size [AW 21 p. 21] in contrast to most of the details of objects observed. When we are also Cooper's detractors [AW 21 p. 21] we should be responsible of observing 100 ft. objects at distances of 100 ft. The angular size of an object subtended in a 10° field would be about the least detected by the human eye [Cooper's] Of course not especially if the object reflected in water the light observed in other situations. Consider the example that the star Betelgeuse which is easily observed in the night sky. Betelgeuse is an orange-red star of 100 million miles in diameter. When we observe it through a 6 inch telescope, that is the minimum angle of resolution determined by the telescope. And this does not represent an error in size. Betelgeuse is emitting light from its surface. Cooper is saying that we can't see the surface of the star from time out with a telescope.

8. In speaking of evolution we usually compare with the state to distinguish two similar objects, as people, cities, animals. But in all cases, evolution means

BAC 111 System

We at Denver think the customers with

[illegible]

R. R. HARRISON
Investment Advisor, Manager
The Reader Corp.
Fidelity Investors, Inc.
London, N. Y.

Caption Error

last term of the July 22 week and approved the Wingate Research Pilot School schedule.

The T-34 Pilot School didn't have F104 aircraft when I graduated five years ago, and judging by the pictures at the top of p. 219 they won't ever have them, either.

Capt E. Grace, Jr.
 Captain USAF
 Staff Sgt. Jerry Smith
 APO 302, New York, N.Y.

(Capt. Givoli's address is as good as his recognition). The system pictured was a McDonald F-101, the risk variable stability aircraft at the school although modification is made out of some Gouss F-105s. Three Lockheed NF-105s with various control systems are being delivered to the school (AR Aug. 7, p. 133), but these are not variable stability aircraft either.)

Back Issues

Now I must deplore, as my collection grows, I will shortly be moving to California. Please advise me whether you would like to

Need some, we wanted you would have
need for a compiler, set of Verilog Wave
(how two or three more). If you cannot use
this set, can you suggest someone who can?

Steve Anderson
67 N. Main, PI
Middletown, N. H.

WALTER HANSEN
Rocky Mtn. Club

(Any subject—Ed.)



Ask Mount Tacoma's
the borders in March
Bolivians To rescue people
about assembly
Kaman borders
Performance were the same
enabled the

Several Tacositos (18,936 lbs) at the port of the Bolivian Peruvian and Chilean borders. In March 1963 an aerial reconnaissance of Mount Tapes just below the summit to rescue people survivors, two Korean HUSKIES were airlifted from South Carolina assembled in a small Peruvian base and ready to go in hours. Twenty six soldiers were flown under extremely adverse conditions in two days. The rescue was successful, but the HUSKIES with their altitude / paginal capabilities enabled the ground rescue team to complete evacuation in 48 hours. Ask the Bolivians about Kamas Performance, or the Peruvians, or the Chileans, Korean Aerial Reconnaissance, Wilderness, Coordinator.



R. R. HARRIS
Assistant Sales Manager
The Bender Corp.
Filipe Passon, Dir.
Lynchburg, N. E.

improve it as good as the
system pictured was
the oak variable stability
and although modification
are given as F 106. There
is with various control
delivered to the school
13%, but these are not
necessarily valid.



For reprints of this symbolic Arzybashev illustration of an early Voyager concept, write: Avco, Dept. AW-4K, 750 Third Avenue, New York 17, N. Y.

Let's take a look. What's behind the cloudy veil of Venus? Or beneath the red sands of Mars? Or on the Moon's pock-marked plains? What's out there in space? NASA is finding out. With Voyager, the Venus/Mars orbiter-lander . . . with Gemini, the two-man rendezvous spacecraft . . . with Moon-bound Apollo . . . with Mercury, the one-man earth orbiter. NASA is extending man's vision to new frontiers in space. Focusing the keen minds of science and industry on the big "Out There." Inspiring studies and projecting plans for perfecting aerospace techniques, shapes, materials, and manufacturing processes. Avco is proud to lend a hand.

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